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Understanding customer need in the new product development context

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This thesis project concentrates on how understanding customer need and customer orientation can be improved in new product development. Understanding customer need during new product development process is very important for product success.

The case company has decided to undertake new product development using LEAN principles. This change creates a need to improve the new product development process. This thesis offers recommendations for the case company's new product development process around improved customer participation and understanding customer needs.

The thesis project was undertaken following an action research approach. Best practices were discovered from the literature and five selected best practices were converted into interview themes. Data was collected by theme interviews. Fifteen case company managers were interviewed to collect information on how the selected best practices suit the case company's processes and usages.

The data analysis was conducted according to a qualitative research approach and the output of the analysis is recommendations for a new product development process where customer participation and need are considered. The first recommendation was validated by interviewing one Program Manager whose task is to improve the case company's current new product development process. Validation was successful and generated one change to the recommendation.

After the validation, a final recommendation for the new product development process was created, integrating customer participation and need.

The next step from this thesis project is to send a release letter about this thesis and its results to the case company's Directors who have the authority to change the case company's new product development process.

Keywords	Customer needs, New product development

Contents

1 Introduction

This thesis concentrates on how companies or organizations can improve their understanding of customer needs in new product development. This thesis is undertaken according to an action research approach and the author of this thesis works for the case company. All of the activities of this thesis project were undertaken within the environment of the case company, therefore it is mandatory to outline some basic information about the company.

1.1 Presentation of the case company

The case company is a medical technology company which offers high-quality dental imaging solutions for dental professionals. The company mainly focuses on X-ray systems, but its product portfolio also contains wide range of other imaging products such as phosphor imaging plate readers and imaging software. The company is not very known in markets under its own name, because it operates under two strong brands which are well known in the dental business market. Both brands have their own wide ranging product portfolio from entry level imaging solutions to advanced imaging solutions. [1]

In 2009 a large multidisciplinary US-based company acquired the case company. Although the case company's customers are located all over the world, sales, research and design and production are located in southern Finland. The company also has sales offices in Europe and USA. [1]

The case company delivers its products and services via dealers, which gives rise to a situation where one provided service or product has two simultaneous customers. The product or service dealer is the first customer and dentist or clinic which uses the service or product is the second customer. Later in this thesis, the first customer will be referred to as the dealer and the second customer will be referred to as the end customer. The case company must concentrate on both customers, i.e. the dealers and end customers. Even if a product is very good for clinics and doctors, you will experience difficulty selling your product in the global market without the dealers, because most clinics tend to buy equipments via a known dealer. On the other hand, if your product or service is very effective for dealers, easy to store and service free, you will

not succeed with it if the end customer does not need such a service or the product is less attractive than competitors' products.

1.2 Business problem and objective

New product development is very important for the case company. It develops at least one or two new products per year. Product development has been undertaken in a structured way in the past. The case company is developing its production strongly under LEAN principles and the high utilization of LEAN principles in production development also requires changes to product design.

Because the case company is constantly developing products, it is easier to make more effective changes to products during new product development. The case company has started to implement LEAN principles in some new product development programs. This creates a situation where the old structured way of undertaking new product development needs to be changed.

The case company has followed a systematic development process with 6 milestones. [2] The figure below shows this process, a system which is known as the Toll gate process in the literature.

PM1 Program start	PM2 Program plan ready	PM3 Specification verified	PM4 Ready for validation	PM5 Ready for pilot deliveries	PM6 Program end
Program manager allocated Preliminary program plan Business case assessment Technology selected	Program plan: objectives, team, tasks, timeline and budget Functional specifications Team allocated Development starts	Prototype built and tested Specifications reviewed and frozen Production capability ramp-up started	In-house clinical evaluation OK Design of all subsystems finished Prototype ready for System Test Launch plan ready	System tests and clinical verification OK Regulatory OK Production, S&M and support capability OK	Product optimized based on pilot customer and operations input Full production capability Development team released, handover to maintenance

Figure 1 [2]

The idea of the process is that the development program has to pass a certain maturity level before it has permission to continue to the next milestone. Practically, this means that the Program Manager arranges a milestone meeting, the program maturity is pre-

sented to the plant management team. The plant management team will make a decision after the milestone meeting, as to whether or not the program is to continue. Quite often the plant management team will decide that the program can continue, but some actions need to be taken before the next milestone. Sometimes the program has difficulty in passing the milestones on time, therefore the plant management team has to make the decision that the program cannot continue before major corrective actions are taken. Practically in that case the milestone and meeting are postponed and the program starts to catch up on its schedule.

Market research is undertaken before the systematic development process or during Milestone 1. Market research has always been done differently, depending on the program and its size. For example, if a product is focused on low cost countries, a couple of marketing managers have visited customers in the target countries. Marketing Managers have created their own questionnaires and used them in interviews with customers. After the interviews, the Marketing Managers have researched the market situation and customer needs and returned the information to the program.

According to the systematic development process, device configuration and features are agreed during the Milestone 3 meeting (Figure 1). This means that all market research has been conducted between Milestones 1 and 3.

As mentioned earlier, the case company has started to undertake new product development according to LEAN principles. LEAN was invented by Toyota and the whole system is based on Toyota production system principles. Table 1 lists the 14 Toyota management principles.

1	Base your management decision on a long-term philosophy, even at the expense of short-term financial goals.
2	Create a continuous process flow to bring problems to the surface.
3	Use “pull” systems to avoid overproduction.
4	Level out the workload (heijunka). (Work like the tortoise, not the hare.)
5	Build a culture of stopping to fix problems, to get quality right the first time
6	Standardized tasks and processes are the foundation for continuous improvement and employee empowerment.
7	Use visual control so no problems are hidden.

8	Use only reliable, thoroughly tested technology that serves your people and processes.
9	Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others.
10	Develop exceptional people and teams who follow your company's philosophy.
11	Respect your extended network of partners and suppliers by challenging them and helping them improve.
12	Go and see for yourself to thoroughly understand the situation (genchi genbutsu).
13	Make decision slowly by consensus, thoroughly considering all options; implement decisions rapidly (nemawashi)
14	Become a learning organization through relentless reflection (hansei) and continuous improvement (kaizen).

Table 1 Toyota Management Principles [3, p.37-41], translation according to [4]

Practically, when a company (like case company) starts to implement LEAN principles in its operations and production, after a certain development level has been reached, product design will be a barrier to continued development.

For example, according to Principle 2 from Table 1, "Create a continuous process flow to bring problems to the surface". Production should be designed to continue properly. A complicated manual assembly workflow makes assembly times vary between work phases. If assembly time varies, you will experience process variation. Assembly can be divided into smaller steps, but practically there will be a level under which you cannot divide it anymore without redesigning the products and their parts. This is only a small simple example of development barriers between production and product design.

The case company has noticed barriers between LEAN production and product development. Among other things, these barriers have strongly driven forward the idea that the case company must run its product development according to LEAN principles.

The case company started to cooperate with LEAN consultants. Table 2 presents some basic principles around the new more LEAN product development. [5]

Visual management

Customer and production process focus right from the beginning
Thorough evaluation of both own and competitor's products
Clear targets
Speedy design iterations from idea to evaluation

Table 2 [5]

The case company has started its first programs using the new method of product development of which the principles are presented in Table 2. Because the new system describes only new methods to do things, not a total work system for every company, the case company still uses the old milestone-based system to ensure that all development requirements such as regulatory issues are covered.

This has created a situation where two new product development systems are being used simultaneously. This generates confusion, but in general the new ideas to improve product development have been very refreshing to the case company and initial results seem to be very good.

Because product development is under change, product marketing in the new product development process needs to be changed or at least re-evaluated. LEAN development tools are based strongly on the idea of "learning by doing". [3] Hence LEAN is naturally a very production oriented development method. The case company must be sure that customer orientation does not suffer because of this strong production focus.

Hence the objective of this thesis project is to establish an improved version of the case company's product development process, which integrates customer participation and customer need into that process.

2 Research process and method

This section concentrates on the research process and methods. This thesis followed the action research method, hence it is mandatory to explain the key steps of this thesis project.

2.1 Key steps of the thesis project

Figure 2, below, displays the key steps of this thesis project.

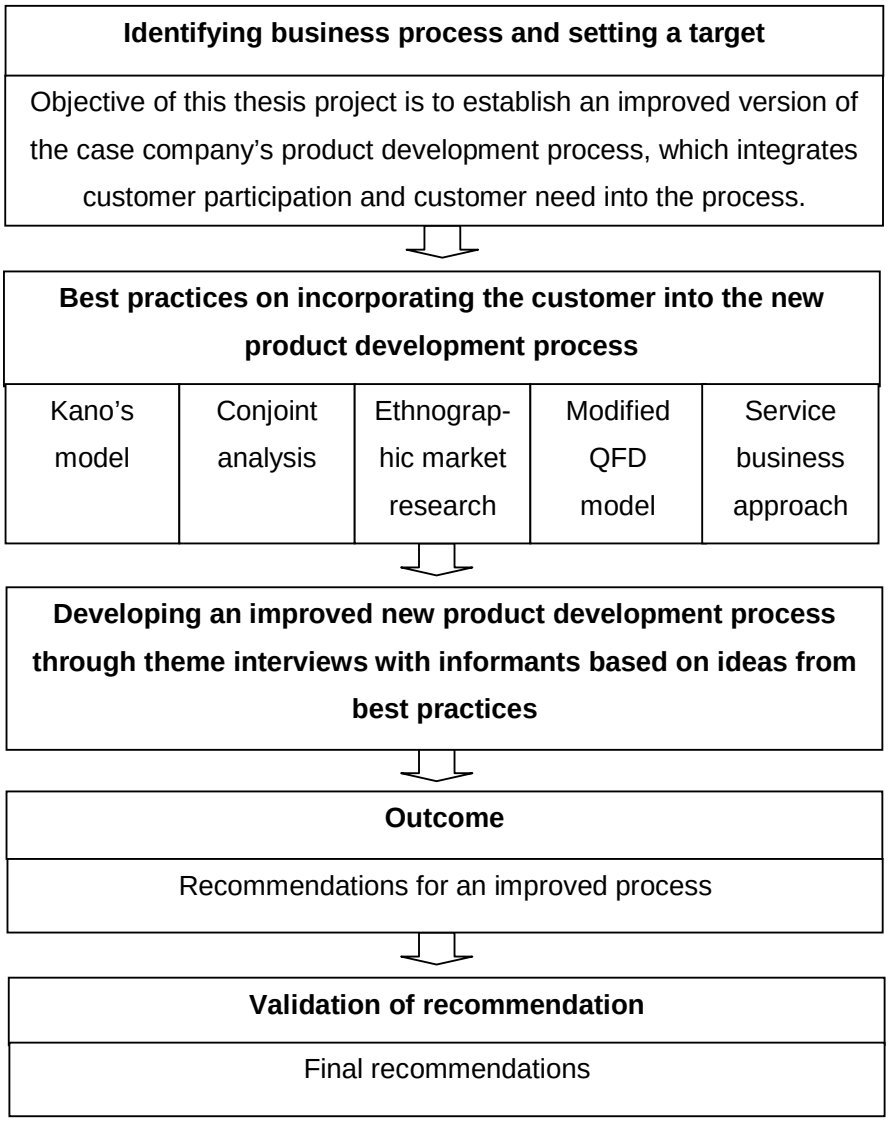


Figure 2. Key steps of this thesis project (Source: author's own work)

Action research was selected as the method for this thesis project because it offers an appropriate approach to this topic in the case company's environment. The researcher works at the case company, has worked on the first LEAN-informed new product program from the start and will start to work on the next similar program during 2013.

The author is a Production Manager at the case company with responsibility for production in both of these programs and this study will deepen understanding of issues inside the programs. The case company uses cross-functional teams in new product development programs and all participants are involved from the start of the program until the end.

2.2 Methods of data collection and analysis

The literature review was conducted using mainly articles from different journals concerning the topic area. Some books and online documents were also used to improve understanding of the topic area. The principal idea has been that using the literature, main concepts and models can be found concerning customer needs analysis in the new product development context. The literature review ends in a section discussing the conceptual framework, where the chosen methods are presented.

It was decided to use case company Interviews for data collection. Interviews were selected, because the idea of interviews is to gain information about the usage of selected models chosen in the conceptual framework. If data collection was undertaken, for example, by email, the explanation of the new models would be too complicated, or at least the email would be too long and complex to be likely to be read by the interviewee. Single face-to-face interviews offer more opportunity to explain the questions more deeply to the interviewee if needed, which is why interviews were selected for use in this thesis project.

The chosen interview method was theme interviews, because this is a semi-structured method and suits this project's needs. Theme interviews offer more space for the interviewee to point out their own ideas, but the interview can be kept under control through use of the questions.

Interviews were conducted in Finnish. Finnish was chosen because the interviewee will feel more comfortable when they can use their own mother language to answer the questions. The question forms were translated by author of this thesis and both English and Finnish language question forms are attached to this thesis. See appendices for more information.

Table 3, below, presents the principal idea of data collection and interviews, where PM1 – PM6 represent the different phases of the case company's current systematic development process. The columns on the left-hand side describe five different models which can be integrated into the case company's current systematic development process.

	PM1	PM2	PM3	PM4	PM5	PM6
Issue / Theme 1	?	?	?	?	?	?
Issue / Theme 2	?	?	?	?	?	?
Issue / Theme 3	?	?	?	?	?	?
Issue / Theme 4	?	?	?	?	?	?
Issue / Theme 5	?	?	?	?	?	?

Table 3. Principal ideas of data collection and interviews (Source: author's own)

Questions are formed according to the conceptual framework described in Section 3.6. The conceptual framework presents five different best practices which can be integrated into the case company's existing systematic development process, which have been chosen to be the themes of the interviews: Kano's model and conjoint analysis to be integrated into PM1; ethnographic market research to be integrated into PM2; the QFD model to be integrated into PM2-PM6; and the service business approach to be involved in the case company's design guidelines.

Interviewees were selected for three different reasons: Directors have the authority to change processes; Managers are working in existing new more LEAN product development programs; and other Managers are closely working in the scope area of this thesis.

Directors who have authority to change processes were chosen to be interviewed because they have a very good understanding of the current process and its strengths

and weaknesses. Also it is appropriate to involve them in this thesis project because they have responsibility to develop or change the current process.

Managers who are working in current new more LEAN product development programs were chosen to be interviewed because they have the best current understanding concerning the new LEAN programs. Also, most of the managers have worked before in programs which have followed the current systematic development process. They have a good ability to compare the current and new models.

Managers who are closely working on the scope area of this thesis were chosen to be interviewed because they have a good understanding of how customer need have been taken in consideration in the current systematic development process. These interviewees mainly work in the marketing area, but also in the new product development area.

All of the interviewees are presented in Table 4 below. The table contains the title, chosen themes and reason for being interviewed, as described above. Altogether, the table contains 15 interviewees: 8 Managers working in existing new LEAN product programs, 5 Managers working in the same area as the scope of this thesis, and 2 higher level Directors who have authority to change current processes.
Interview themes:

1. Kano's model - integration into Process Milestone 1
2. Conjoint model - integration into Process Milestone 1
3. Ethnographic market research - integration into Process Milestone 2
4. Modified QFD-model - integration into Process Milestones 2-6
5. Service business approach principles - to be involved in design guidelines

Interviewees 1, 2, 5 and 8 chose to answer Themes 3, 4 and 5, because these themes are strongly related to teamwork, decision-making and how to control the process as a whole. These interviewees work closely around these issues in the case company.
Interviewees 3, 4, 7, 9, 10, 11, 12 and 13 chose to answer Themes 1, 2 and 3, because these themes are strongly related to market research. These interviewees work closely with market research issues in the case company.
Interviewee 6 chose to answer all of the themes because he is developing the case company's new product development process.

Interviewees 14 and 15 have chosen to answer all of the themes because they are responsible from start to end concerning the case company's new development process.

	Title	Themes	Reason to be interviewee
1	Program Manager	3, 4, 5	Work in existing new program
2	Project Manager	3, 4, 5	Work in existing new program
3	Product Manager	1, 2, 3	Work in existing new program
4	Business Area Director	1, 2, 3	Work in existing new program
5	Program Manager	3, 4, 5	Work in existing new program
6	DBS Leader	1, 2, 3, 4, 5	Work in existing new program
7	Product Manager	1, 2, 3	Work in existing new program
8	NPI Manager	3, 4, 5	Work in existing new program
9	Product Manager	1, 2, 3	Closely working in same area
10	SW Product Manager	1, 2, 3	Closely working in same area
11	Product Manager	1, 2, 3	Closely working in same area
12	Product Manager	1, 2, 3	Closely working in same area
13	Product Manager	1, 2, 3	Closely working in same area
14	Vice President R&D	1, 2, 3, 4, 5	Director with authority
15	VP/General Manager	1, 2, 3, 4, 5	Director with authority

Table 4. List of interviewees.

Interview Invitations were sent by email to the interviewees. Participation was explained as voluntary and the reason to be interviewed was explained in detail. The invitation email also contained basic information about the reason for the interviews, to avoid confusion about the purpose of the interviews.

The questions were not sent beforehand to the interviewees. Questions and models were presented to the interviewees during the interview session. The time for the interview was given as half an hour, but at the start of the interview, the interviewee was told that interview could take as long as necessary. The interview period was 11.2.2013–5.3.2013.

Interview invitations were originally sent to sixteen interviewees and an interview appointment was successfully agreed with 15 interviewees. One Product Manager could not find time for the interview until it would be too late for the researcher. It was decided

to continue the thesis project without this interviewee, because all of the other Product Managers had been successfully invited.

2.3 Reliability and validity

The reliability of this thesis is based on the principle that all actions will be related to the reader, explaining what has been done, why and how.

It is important to make a surface distinction between quantitative and qualitative methods when discussing the research methodology, as the data collection differs under the two principles In the case of qualitative research, data will be collected mainly in the form of words, and in the case of quantitative research, data will be in the form of, or can be expressed as, numbers. [17, p. 82-83] However, this can lead to confusion, as Easterby-Smith, Thorpe and Jackson mention: “Simplification can lead to confusion, because qualitative and quantitative methods may be used according to both constructionist and positivist epistemologies, and be underpinned by both nominalist and realist ontologies”. [17, p. 82-83]

If a distinction must be made, this thesis project has been undertaken according to the qualitative research method. The main reason for this is amount of data and the method of data collection through theme interviews.

Qualitative research has two phases: Simplifying observations and solving a mystery or problem. Quantitative research might have similar steps. In both methodologies, the observation creation phase uses techniques to decrease the observations to a more suitable size. In the case of qualitative research, observations are decreased for the theme interview or group discussion by considering only certain topics which presumably belong to the theme. Mostly this phase will be made afterwards. [16, p. 50-51]

Tuomi and Sarajärvi list some basic details which need to be considered when estimating the reliability of research. [15] The details to be considered throughout this thesis project are:

- Purpose and objective of research
- Own commitment as a researcher in this research
- Data collection
- Research data sources

- Source–researcher relationship
- Research schedule
- Data analysis
- Reliability of research
- Research reporting

The validity of this thesis is based on four different issues:

- Expertise
- Best practices from literature
- Colleague support
- Evaluation of recommendations

The author of this thesis has had a long career in production engineering and management. Also, the author has been working in an existing new LEAN product development program in the case company, gaining good knowledge about the program and how issues have been considered inside the program. The author is responsible for the production part of the program.

Best practices were taken from literature, mainly from journals. According to the literature, all of the five selected models are widely used in other companies.

Evaluation was undertaken by a colleague outside of this thesis project. One Program Manager is dedicated to improving the case company's new product development process. This Program Manager was not interviewed for this thesis, because he was chosen to evaluate the recommendations. This was done in a face-to-face interview with the evaluator, creating the evaluation in dialogue between author of this thesis and the evaluator. As with the other interviews, the meeting request was sent by email. The time specified for the meeting was 1.5 hours. The evaluator was told at the beginning of the interview that the interview could take long as necessary.

3 Best practices around understanding customer needs in the new product development context

This section presents different kinds of model using which customer needs in new product development have been taken into consideration in the literature. The final sub-section, Section 3.6, presents the conceptual framework.

Comparing the different methods for involving customer needs in the new product development process requires a framework to which the methods can be related [11, p. 4]. Kaulio (1998) proposes a framework based on two dimensions [11, p. 4]:

1. The longitudinal dimension, which includes the points of interaction between customers and the design process. [44, p. 4]
2. The lateral dimension, which captures the depth of customer involvement in the design process. This dimension is divided into three categories:
    a. design for, where the products are designed based on customer research but the customer is not further involved
    b. design with, denotes an approach which, in addition to the above, also includes displays of different concepts for the customer to react to
    c. design by, signifies an approach where customers are actively involved and partake in the product design [11, p. 4].

Stefan Lagrosen proposed a framework in his research, where customer involvement has three levels of relationship with the customer: Transactional, facilitative and integrative. [11, p. 10] Table 5 explains his proposed framework.

Level of relationship	Longitudinal customer involvement	Lateral customer involvement	Suitable methods
Transactional	Only in the early phases	Design for the customer	Surveys, focus group interviews, observation
Facilitative	In the early phases, in the testing phase and occasionally in the other phases	Design with the customer	QFD, Delphi method, conjoint analysis, prototype testing, beta testing, team customer visits
Integrative	In all phases	Design by the customer	Integrated product development teams including representatives of both the supplier and the customer

Table 5. A proposed framework for customer involvement in different levels of relationship [11, p. 10]

The framework that Lagrosen proposed has been chosen for this thesis, because he has collected different areas of customer involvement effectively from the other litera-

ture and the presented framework considers customer involvement in the new product development context.

3.1 Kano's model

Kano's model is been used to clarify customer satisfaction concerning different attributes of products. Kano's model represents how customers are satisfied or dissatisfied about certain features, categorizing features into three categories. Kano's model has been chosen for this thesis because it helps the user to understand customer needs and presents a total model for this. However, Kano's model itself does not offer always the correct answers. It offers systematic knowledge about different product features. [6, 18] Figure 3 shows the categories of Kano's model [6, p.3].

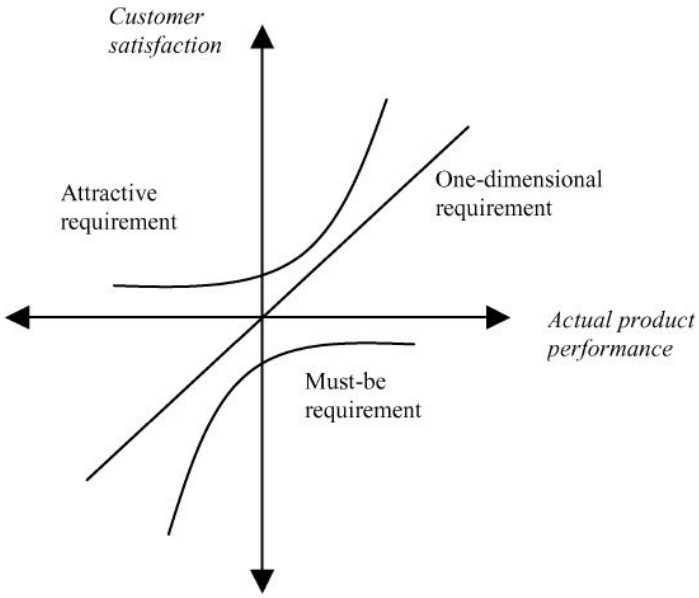


Figure 3. Kano's model of customer satisfaction [6, p.3]

The illustration shows three categories:

- One-dimensional requirement
- Must-be requirement
- Attractive requirement

The one-dimensional requirement means that the customer is satisfied when it is fulfilled and unsatisfied when it is not fulfilled. A higher level of fulfillment means a higher level of satisfaction. This type of requirement builds customer loyalty. [6, p.3]

A must-be requirement is a basic criterion of a product, since if it is not fulfilled, the customer will be extremely unsatisfied. [6, p.3] However, its fulfillment does not increase satisfaction, since the customer takes it for granted. [6, p.3] If must-be requirements are not fulfilled, customers are not attracted to the product. [6, p.3]

An attractive requirement is the highest criterion of the product or service, which affects customer satisfaction. [6, p.3] This can be something that customers do not even know about before they use it. On the other hand, if this requirement is not met, there is no dissatisfaction. [6, p.3]

Data collection differs from traditional customer surveys. It is achieved through specific questionnaires, which contains pairs of questions. One product feature has one pair of questions, functional and dysfunctional. Table 6 shows five functional questions and five dysfunctional questions. [6, p.3-4]

KANO EVALUATION TABLE

		Dysfunctional form of the question				
		I like this feature omitted	**I need this feature omitted**	**I am neutral about this feature**	**I can live with omitting this feature**	**I dislike omitting this feature**
Functional form of the question	**I like this feature included**	*Q	*A	A	A	*O
	I need this feature included	*R	*I	I	I	*M
	I am neutral about this feature	R	I	I	I	M
	I can live with including this feature	R	I	I	I	M
	I dislike including this feature	R	R	R	R	Q

*A: Attractive requirement, *O: One-dimensional requirement, *M: Must-be requirement, *I: Indifferent, *R: Reverse, *Q: Questionable.

Table 6. Example of Kano's model evaluation table [6, p.4].

Three more categories are needed for full use of Kano's model:

- Indifferent requirements (I)
- Reverse requirements (R)
- Questionable requirements (Q)

Indifferent requirements mean that the customer is indifferent to this product attribute and is not very interested in whether it is present. [6, p.3]

A reverse requirement means that, not only do customers not desire that product attribute, but they also expect the reverse of it. [6, p.3]

Questionable requirements indicate that the question was phrased incorrectly, the customer has misunderstood the question, or an illogical response was given [6, p.3].

The next step is to use table for find what feature belongs to which criteria presented in Figure 2. All questionnaires were considered separately with the table. A feature belongs to the category where the percentage is largest. For example, if 45 percent of answers are in the must-be requirement category and 15 percent of answers are the in one-dimensional category, that specific feature belongs to the must-be requirements. [6, p.4]

Absolute importance values can be calculated by using Formulas 1 and 2 shown below.

$$S_i = \frac{A_i + O_i}{A_i + O_i + M_i + I_i}$$

$$D_i = \frac{M_i + O_i}{A_i + O_i + M_i + I_i}$$

Formulas 1 and 2. Absolute importance formulas of Kano's model [6, p.4]

Ai, Oi, Mi and Ii represent the percentages of responses from Table 3, for i=1,...,m, and m is the total number of customer requirements. Importance is shared by two impact terms: Impact on customer satisfaction (Si) and impact on customer dissatisfaction (Di). (Si) indicates how much influence over customer satisfaction is increased by providing a particular customer requirement and (Di) shows how much the influence on customer satisfaction is decreased by not providing that customer requirement. [6, p.4]

Kano's model, presented above, offers a good opportunity to discover product attributes and definitely helps in choosing the correct ones. The model particularly highlights the fact that with some customer attributes, customer satisfaction is dramatically increased with only a small improvement in performance, while for other customer

attributes, customer satisfaction increases only a small amount even when product performance is greatly improved. [6, p.3] This means that using this model a great opportunity for the case company. Another important point is that when a structured model is used, it is easier to use it in the same way each time, which makes sense in the long run.

One challenge for the case company environment is customer structure. This must be investigated properly before using the Kano model, in terms of how dealers and end customers will be considered. This mainly means that the case company must make a decision as to whether they use Kano's model separately for dealers and end customers or all in one. The result of the model will heavily depend on this major decision.

Another critique against Kano's model is complexity of decision-making because sometimes it is statistically impossible. Of course this happens only when the numbers of inputs are close together. For example, if the number of inputs for the one-dimensional category is 40 and for the indifferent category 37, it is not statistically possible to conclude that the requirement is one-dimensional, even though it is the most frequent observation. [6, p.4]

Kano's model belongs to the transactional level of relationships in Lagrosen's proposed framework, because data is to be collected, for example, by surveys and that is why Kano's model should be used at the beginning of the new product development process if we look at it from the longitudinal customer involvement viewpoint.

3.2 Service business approach

One way to understand customers and customer needs better is to change to thinking in a more service business way. Of course that does not mean that all companies must only consider service and lose, for example, manufacturing knowledge and technical capability. It also means that it is good for manufacturing companies to understand that customers have certain processes, and the manufacturing company, as a supplier, can support these customer processes.

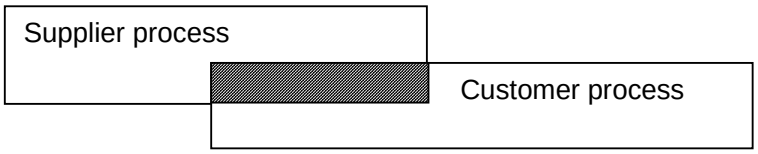


Figure 4. Processes in the service business approach [7]

Figure 4 shows the principles by which the supplier and customer processes can match up. In this figure, the matching is only part of the process and takes place only at one time. In practice, it can be a short part of the process and can happen during any part of the service process. [7]

The case company has a long history as a manufacturing company. This naturally creates a situation whereby the company looks most at issues from a manufacturing viewpoint. Turning more to a service approach can offer the case company a huge opportunity to deepen its understanding of customer needs.

Changing the approach towards a service mode is long term process and several principles must be kept in mind. Figure 5 presents three different ways for a company to develop its operations and knowledge towards more of a service business approach. [7]

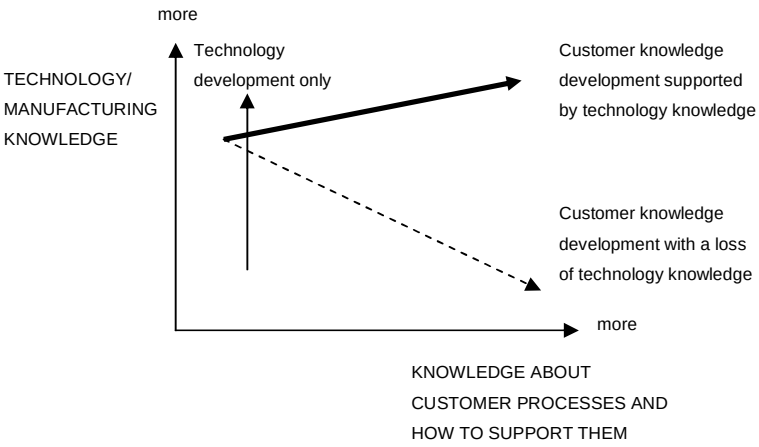


Figure 5. Moving towards a service business knowledge base in manufacturing [7, p. 441]

The thin line shows the traditional way in which a manufacturing company creates competitive advantage based on a knowledge base geared towards technology and

manufacturing processes [7, p.441]. This type of development focuses only on the technical process and deepens understanding of it, but understanding of the customer process remains the same. [7]

The dotted line illustrates the worst development that can happen. The company focuses too much on supporting customer processes and loses its capability to offer technical support in the form of products to its customers. [7, p. 441]

The thick line indicates the way in which to become a service business. The company obtains knowledge about customer processes as well as how they, and through them business processes, can be supported, so that value is created in all processes. [7, p. 442]

As Figure 5 presents, companies have to choose their method of developing very carefully. The correct way for a manufacturing company is to support customer knowledge development with technology knowledge development. [7, p. 441-442]

As mentioned above, when a manufacturing company changes its thinking towards a service business approach, the basic principle is supporting customer process. Figure 6 presents one model of thinking in a more service-oriented way. [7]

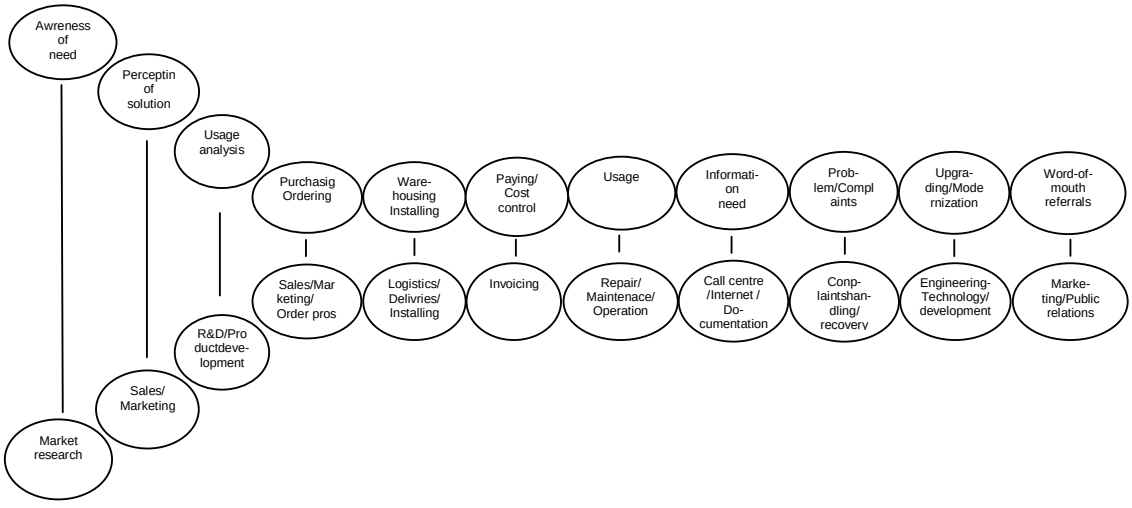


Figure 6. The customer lifecycle and supplier support chains [7, p. 439]

In this figure the processes relate to another industry and it must be considered as an example. The upper chain represents the customer processes and the lower chain the

supplier processes. The line between processes represents a link between those processes.

The service business approach has been chosen for this thesis because it presents a whole new way of thinking in developing the case company's operations in the thesis scope of new product development.

The service business approach offers a wider possibility to deepen understanding of customer need across the whole organization, and the eventual improved understanding of customer processes will also support new product development. For the purpose of this study, it is very important point to note that the service business approach supports discovering the customer's own processes and how new product development can support them.

The service business approach is clearly on the integrative level of relationships in Lagrosen's proposed framework. On that level of relationships, the customer has its own representatives in the new product development program. [11, p. 10]

3.3 The QFD model

Quality function deployment (QFD) is very well-known set of methods for incorporating customer requirements into new product development. The principal idea is that by using market research, the desired customer attributes (CAs) are collected in a list, which is turned to into a list of engineering attributes (EAs). The engineers then use these attributes to create products. One very good aspect of using QFD is that it improves communication between marketers, engineers and manufacturing staff. [8, p. 651, 19]

The QFD model has been chosen for this thesis because it is a very well-known and effective tool for incorporating customer attributes into new product design. Market research and customer attributes were known about before, but successful new product development must include good tools to integrate customer attributes into product design.

One of the key principles in the QFD model is the so-called House of Quality. This is designed to deploy customer input throughout the design, production, marketing and

delivery facets of a given product or service. [9, p. 2] In a typical QFD application, a cross-functional team creates and analyses a matrix linking customer wants and needs to a set of product and service design metrics that the company can then measure and control. [9, p. 2] Figure 7 demonstrates the general structure of the House of Quality.

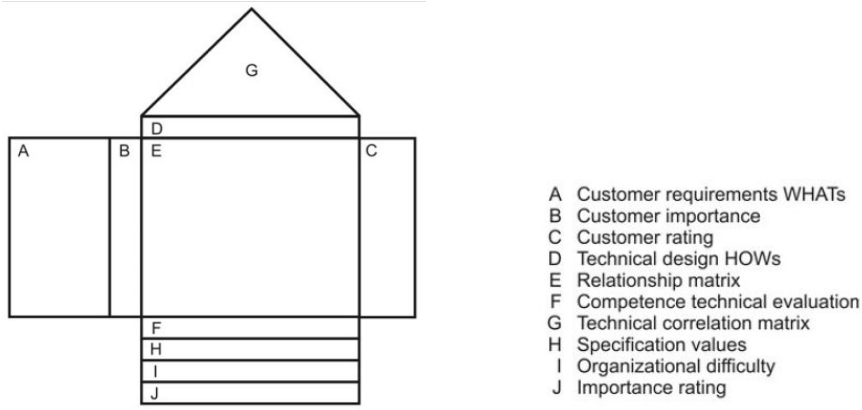


Figure 7. The House of Quality: general structure [9, p. 2]

A - customer requirements is a structured list of requirements derived from customer feedback. [9, p. 4]

B and C - customer rating illustrates customer perceptions observed in market surveys, including the relative importance of customer requirements (B) and company and competitor performance in meeting these requirements (C) [9, p. 4]

D - technical descriptors is a structured set of relevant and measurable product characteristics. [9, p. 4]

E - relationship matrix is an illustration of the QFD team's perceptions and interrelationships between technical and customer requirements. [9, p. 4]

G - the technical correlation (roof) matrix is used to identify where technical requirements support or impede each other in the product design. [9, p. 4]

F and H - technical priorities, benchmarks and targets are used to record the priorities assigned to technical requirements, measures of technical performance achieved by competitive products and the degree of difficulty involved in developing each requirement.

The final output of the matrix is a set of target values for each technical requirement to be met by the new design (F and H), and these are linked back to the demands of the customer. [9, p. 4]

I - organizational difficulty is the phase where the team rates the design attributes in terms of organizational difficulty. [9, p. 13]

J - importance. This numerical calculation is the product of the correlation index between each listed issue in the A & B and each listed issue in the D section of the house. [9, p. 13]

The implementation of House of Quality and QFD is complex task and the literature lists many different ways to do this. Many researchers describe the process sequentially, but actually it is iterative. [9, p. 4]

The process can be shared for example in a four-step model: [10, p. 3]

1. Product planning: house of quality
2. Product design: parts deployment
3. Process planning
4. Process control (quality control charts)

In the first phase, the most important engineering characteristics that satisfy most of the customer demands are defined by scoring. The output of first phase is a list of important characteristics for next phase.

In the second phase, the defined engineering characteristics are considered along with part characteristics, and output is a list of important part characteristics for the next phase.

The third phase considers the defined part characteristics along with key process operations. The output is important characteristics for the fourth phase. The fourth and last phase considers key process operations and production requirements. The output of this phase is also important characteristics. All of these four phases together make up the QFD process life cycle. [10, p. 3]

QFD is a comprehensive product development tool and can be used to give ideas for developing a company's own product development system. Another way to utilize knowledge of the QFD system is to make it in the company own way. The company can, for example, implement the whole system first in one new product development program and during the first program make its own notes and evaluations on the system. Then the QFD system can be modified so as to better fulfill the company's own needs.

The QDF model represents the facilitative level of relationships in Lagrosen's framework proposal. It is mostly used in the early phases of new product development if we look at it from the viewpoint of longitudinal customer involvement. [11, p. 10]

3.4 Ethnographic market research

Ethnographic research methods are also used in market research. The basic idea of ethnographic market research is that customer will be in their own familiar environment. When an interviewee is in a familiar environment, their answers will be more informative. Ethnographic market research reveals issues with existing products and services, but it also facilitates understanding of customer attitudes, perceptions, and needs, both rational and emotional. [12] Ethnographic market research has also been used in the health care sector. [12]

Ethnographic research can also be conducted by recording video. For example, medical staff can be filmed when they are preparing operating rooms, preparing patients, conducting the operation, and moving the patient to recovery room. The recordings can be used afterward to aid the development of a service or product. [12]

Ethnographic market research can also be implemented by a new product development group making customer visits to understand customer needs better. Fluke presents good experience in making that kind of customer visit. Fluke's Documenting Process Calibrator product line has become a great success, another testimony for understanding customer needs, and designing a superior product in response to those needs [13]. Ethnographic market research is also called "camping out", "fly on the wall "or "day-in-the-life-of" research. [13]

In this kind of market research method, the relationship with the customer plays a very important role. Therefore, it is usually better to start by cooperating with the most important customers. Contact with smaller customers concerning this kind of activity can be challenging. [13]

Using ethnographic market research relates to the integrative level of relationships in Lagrosen's framework proposal, mostly from a lateral customer involvement perspective. [11, p. 10] Ethnographic market research has been included in this thesis because it is known to be a good tool for improving customer understanding. Some high technology companies and health care technology firms are known to have also used this method. [13]

3.5 Conjoint analysis

Conjoint analysis is known as a tool which helps to determine product features in new product development. It is basically a mathematical model, which gives answers by putting them in order of importance. For example, a product has three different lengths: short, medium and long, and three different materials: metal, plastic and wood. These parameters are put into a matrix. Table 7 below shows an example matrix for conjoint analysis.

	Short	Medium	Long
Metal	3#7	2#8	1#9
Plastic	9#1	8#2	7#4
Wood	4#3	5#5	6#6

Table 7. Example of conjoint analysis matrix [8, p. 646-647, 14]

It may be known, for example, that a long product made from metal is the optimal product, but making this costs a large amount compared to other options. Another known issue is that a short product made from plastic is very cheap to produce thus the most cost effective choice. It can be calculated from these facts above that the best solution for starting to design a product lies between the optimal product and the cheapest product. Conjoint analysis also offers the possibility to see other ways than the best solution. If a product development group is designing a high quality long last-

ing product they can see the customer needs from the conjoint data, which supports their own choice. [8, p. 646-647, 14]

If we then ask consumers which kind of products suits their needs, the answer will differ depending on who is answering the question. Consumer 1 might say that the product must last for a long time and must be made from metal, and it does not matter how much it costs. Consumer 2 might say that they need to use this product only sometimes and that's why it is not worth paying too much, plastic will be the best option for their need.

Now, because every consumer cannot have different products, the product development group must decide which kind of product they will start to design. This is the basic idea of using conjoint analysis. [8, p. 646-647, 14]

The next step from the matrix (Table 5) is to create consumer surveys. Surveys are undertaken using questionnaires, where consumers are asked to rank different product possibilities in order of importance. Consumer 1 is represented by the number before the hash mark and Consumer 2 by the number after the hash mark. [8, p. 646-647, 14]

After values are integrated into the matrix and calculation operations have been done, the output of the analysis gives the total values of the different choices. Then the product development team can make a decision based on the different total values of the choices. [8, p. 646-647, 14]

Conjoint analysis does not have a high start-up cost. In practice, it is better to use templates or other computer based programs, because a large amount of data can make its use very difficult or at least very time consuming. [8, p. 646-647, 14]

A negative point of using conjoint analysis in new product development is that measurable features have to be known before it is used. Conjoint analysis works better when different features are already known and users like to have customer input at this stage. If the product has a lot of questionable features, conjoint analysis may not be the best solution. [8, p. 646-647, 14]

Conjoint analysis belongs to the facilitative level of relationships in Lagrosen's framework proposal and if we look at it from a longitudinal customer involvement viewpoint, it

is prepared in the early or testing phase of the new product design process, or occasionally other phases. [11]

Conjoint analysis has been chosen for this thesis because it is very well-known marketing method, which supports the user in making choice between different product features. Its practical use needs more concentration and this is only a short description of the basic ideas of conjoint analysis.

3.6 Conceptual framework

This sub-section describes how the chosen models can be integrated into the case company's new product development process. Previously we have presented five different models to improve understanding of customer needs in the new product development context: Kano's model, conjoint analysis, ethnographic market research, the QFD model and the service business approach. Now we will explain the principles of how to integrate these into the case company's systematic development process.

If we take Lagrosen's framework proposal, it includes longitudinal and lateral customer involvement. Those two different views can also be taken in consideration in the case company environment. The lateral customer involvement viewpoint means that the customer is involved basically throughout the process, as with the above-mentioned service business approach. The case company did not previously involve the customer in every step of the product development process. To change the whole case company development process to a method in which the customer is involved in every step of the process is naturally very time consuming and must be fully endorsed by the management team. Changing management structures and processes does not fall within the scope of this thesis scope, hence the researcher has chosen to utilize longitudinal customer involvement from Lagrosen's framework proposal. [11, 7]

Kano's model and conjoint analysis are the tools which are used to investigate customer needs, as mentioned above. If we examine the case company's systematic development process (Figure 1), it can be seen that business case assessment will be undertaken during the PM1 phase. Thus it is natural for Kano's model and the conjoint analysis tools to be used in the case company's PM1 phase. [6, 14]

Use of conjoint analysis can be limited in the case company environment, because product features need to be chosen before analysis, and the amount of features can be limited because of the analysis structure. But in cases where features are well known and the case company needs to evaluate the customer thinking behind those features, conjoint analysis can be good choice to use. Because the case company develops very different products, this method can be used, for example, for simpler products. [6, 8, 14]

Kano's model offers a good possibility to also discover customer needs in the case of a more complex product structure. The case company could use it as a market research tool, or it could be integrated into the new product development process. Many companies have integrated Kano's model into their own new product development processes and some companies have integrated it into the QFD model. More information about the integration of Kano's model into companies' own processes can be found in the literature. [6]

Ethnographic market research methods like "fly-on-the-wall" also offer a good possibility for the case company. The case company uses cross-functional teams in new product development, with at least quality, production, marketing and after sales representatives. Fluke has, for example, conducted ethnographic market research by sending a whole engineering team to a customer to evaluate the customer's processes and problems more deeply. The case company could try similar customer visits. [12,13]

In the case of ethnographic research some preliminary work needs to be done. Customers must be chosen carefully, because customers must gain some benefit from this kind of visit. For example, small customers may not understand why their supplier is investigating their work, but larger customers can see the opportunity to improve their own processes as well. Another issue is that the case company environment includes dealers and end customers. Maybe dealers can arrange visits to end customers at the same time.

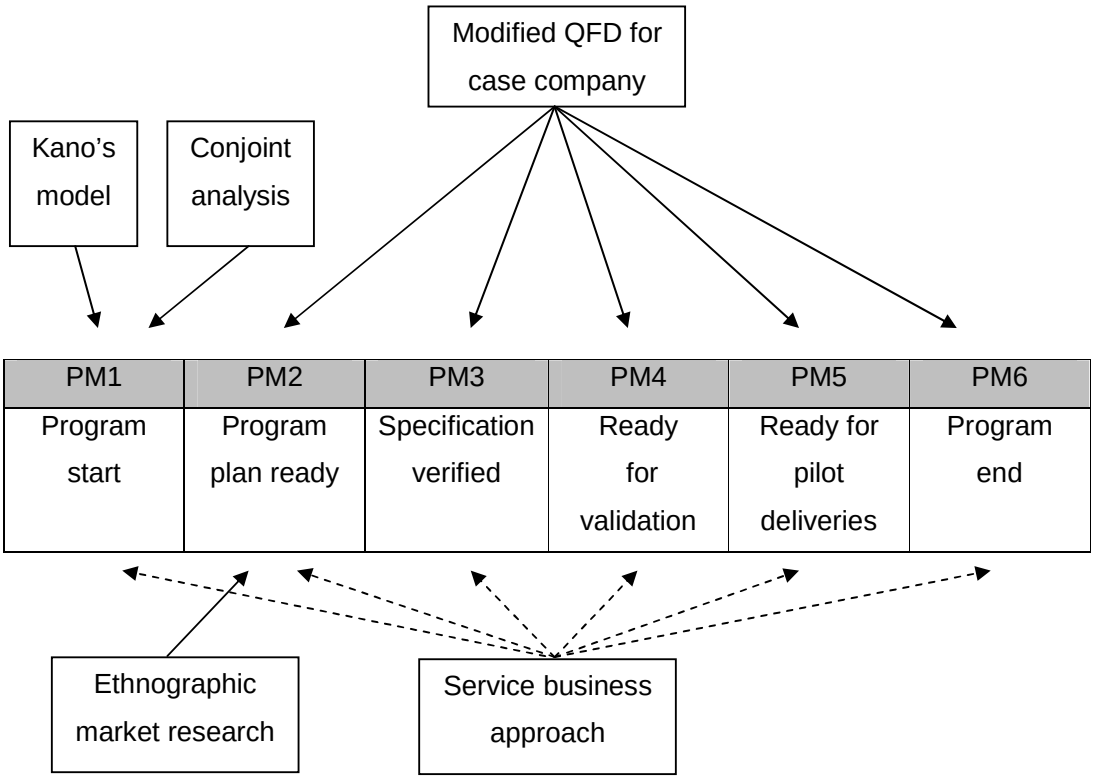
The main issue about ethnographic market research in the case company is that the whole cross-functional team must participate in the market research. That is why it is natural that ethnographic market research is undertaken during the PM2 phase of the case company's systematic development process. [12, 13]

The case company has started to use some QFD tools in its first more LEAN product development programs. QFD is also very prevalent in literature and is a very good tool for promoting team work during new product development. [9, 10]

The case company could investigate QFD tools in first new LEAN programs and collect tools for its own systematic development process. Alternately, it could build a totally own QFD system based on QFD tools. QFD system tools can be clearly seen to be in use between PM2 and PM6 in the case company's systematic development process. [9, 10]

The service business approach is another way of thinking about customers and customer relationships. The case company is strongly located in manufacturing business, but the service business approach offers fresh thinking towards customers. The service business approach is not easy to integrate by looking at customer involvement from longitudinal view. As mentioned above, lateral customer involvement requires change to the whole process and is outside the scope of this thesis. The case company could add the customer process view to its design guidelines, to increase its understanding of customer needs. Another way is to add customer process investigation to the design guidelines. [7, 11]

Figure 7 illustrates the case company systematic development process, with the addition of the five models under discussion: Kano's model, conjoint analysis, ethnographic market research, a modified QFD model for the case company and the service business approach.



Picture 8. The five models which can be integrated into the case company's systematic development process.

4 Developing an improved new product development process

This section considers the data analysis and presents how the case company's new product development process can be improved. At the end of this section recommendations are given for improvements to the new development process for the case company.

4.1 Data analysis

Fifteen interviewees were interviewed. Their answers varied: some of the interviewees were very interested about the models that were presented and some did not understand the models even when they were explained several times. It is envisaged that the working environment affected the interviewees' answers.

Generally the situation in the dental imaging business during interview period was that everybody was preparing for the largest exhibition in this business field. This gave rise to a situation where everybody had many work tasks to do at same time and this probably lowered their concentration on the interview questions. Naturally there are differences between the individuals. Some of the interviewees were very calm and relaxed and others had difficulty concentrating on one topic at a time, even though their stress levels were the same.

The questions were presented in a similar manner to every interviewee in order to avoid bias as much as possible.

4.2 Kano's model analysis

Kano's model was proposed for use during the PM1 phase of the case company's new development product process. After presentation of the model, many of the interviewees noticed that Kano's model can be used to find attractive product requirements. Some of the interviewees pointed out that using Kano's model is very time dependent. For example if Kano's model has been used to evaluate the three best production features six months ago and the conclusion was that Features One, Two and Three are attractive and Features Four and Five are one-dimensional, if exactly the same research is undertaken today, the result might be, for example, that Feature One is still

attractive, Features Two, Three and Four are one-dimensional and Feature Five is a must-be requirement. That kind of change can happen, for reasons including market behavior and how markets are changing.

In the example above, Feature One kept its place as an attractive feature. That can happen because other companies have not presented that specific feature to the market. Features Two and Three have dropped into the one-dimensional category because other companies have presented the same or similar features to the market. Feature Five has dropped into the must-be category, because at the moment every product in the marketplace has the same feature and almost every customer knows this, causing Feature Five to drop into the must-be category.

Kano's model was used as a question for eleven interviewees. Ten of the interviewees were positive that Kano's model can be used at least at some level in the case company.

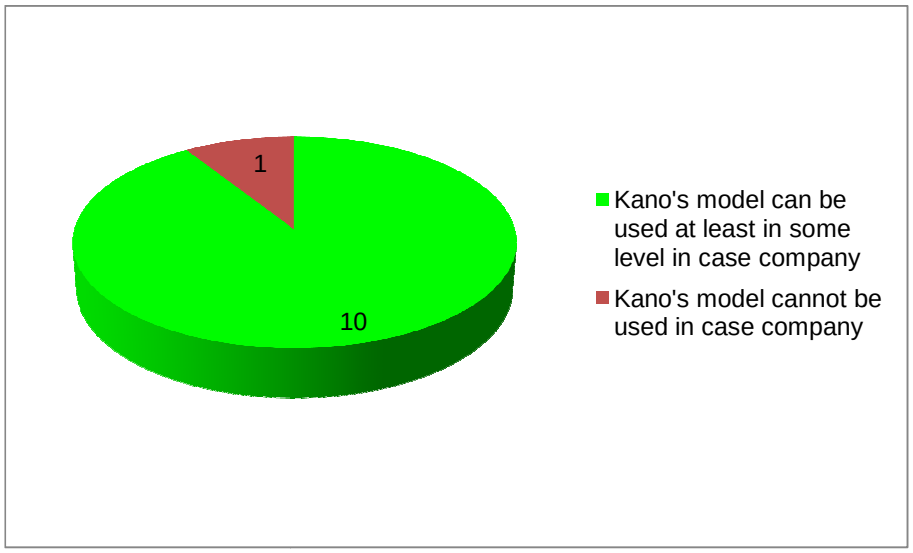


Figure 9. Usefulness of Kano's model to the case company.

The interviewee who did not consider Kano's model useful for the case company complained that if the user of the model does not understand the features accurately enough or does not know at all which kind of features are needed, the model will not give the appropriate answers.

Some other interviewees also mentioned that the selection of the features must be made judiciously. Therefore it can be stated that the selection of the features is a very important issue.

With some of the interviewees, discussion about feature selection was very fruitful. Two interviewees proposed using knowledge from previous programs. They proposed to use feedback from clinical evaluations. The case company uses clinical evaluation before launching a new product, and this is done during the PM4- PM5 phase in the case company's current new product development system.

It is a good idea to use clinical evaluation feedback, but this narrow view of the topic can be difficult. If clinical evaluation is used to collect features for Kano's model, information only comes from one clinic and represent's one doctor or nurse' opinion about the issue.

One proposal for feature selection was to use knowledge from competitor features. The case company has used competitor evaluation in the first new LEAN new product programs. The idea is that competitors will be investigated accurately and all features will be logged. When two to five competitor features are logged, an evaluation table will be made. The program team can choose the most important features from the table for their own product design. It was proposed to utilize these chosen features in Kano's model and investigate what customers like about them.

All of the interviewees agreed that Kano's model should be used as early as possible, preferably during the PM1 phase as proposed. Some of the interviewees said that PM2 is too late and some said that PM2 is the absolutely latest stage for using Kano's model.

One of the interviewees was very impressed by the model and wanted to use it in one of the case company's new product programs. She said that they are just in that early phase where marketing investigation is to be done. They are just discussing choosing the key features of the program. She had seen Kano's model presentation before, but had not seen it used this widely.

One of the popular topics during the interview about Kano's model was "where are the questions to be sent?" Many of the interviewees pointed out the choice must be made

carefully as to who to send question forms to. These interviewees wanted to work with dealers and end customers separately. Dealers consider what end customers need, but they can still have very different views about features. Clearly, the end customer sees more closely the real operation of the offered service while the dealer looks more at how to sell the feature to the end customer. These interviewees maintained that this difference is so important that questions must be sent separately to dealers and end customers.

Some of the interviewees took cultural issues into consideration during the question on Kano's model. They pointed out that different countries and cultures must be kept separate, with their. own questions or at least separate data sorting. They mentioned that the same product can be used totally differently in different cultures. For example, in the United States, dental clinics use intra oral imaging to take whole mouth dental images. That means several intraoral exposures at same time and the patient will wait in the chair for the whole time, while the dentist and nurse operate around the patient. It is very understandable that in the United States patient position and process time are more important features than in other countries, where only one intra oral image will be taken at a time. In those countries, for example, image quality may be a more important issue.

Many of the interviewees said that Kano's model is a good tool for testing feature ideas. Kano's model offers data for the new product program and the program team can utilize it for making decisions.

Many of the interviewees also stated that Kano's model is systematic, because it is mathematical model: this was seen as positive. Only one interviewee said that a problem with mathematical models is visualization of data. He said that the output would always be numbers and that presents a challenge.

4.3 Conjoint model analysis

Conjoint analysis was proposed for use in the case company's PM1 phase. Many interviewees pointed out that first Kano's model would find the appropriate features and conjoint analysis is the next stage, because the features must be known before analysis. It is very difficult to find new features using the conjoint model.

Many of the interviewees saw different opportunities with this model. The simplicity of the model was seen as one of its biggest positive issues.

The conjoint model was seen good tool for evaluating the price level of certain features. Some of the interviewees proposed a model whereby conjoint style market research circulated several times to find the price of the specific feature. This idea of this circulation is that the price level will first be targeted very high with specific features. If customers do not choose that feature, then the price will be lowered and the same market research performed again. This will be circulated as long as it can be seen that most customers are starting to choose a specific feature. This circulating kind of usage of the conjoint model was very interesting, and finding the correct price level is always very difficult. The conjoint style of market research will definitely help to make this complicated task more systematic.

Some of the interviewees pointed out that a problem with market research is that customers want to have all of the features offered. Conjoint analysis will help to solve that problem.

Conjoint analysis was a question for eleven interviewees. Ten of the interviewees would use conjoint analysis in the case company. One interviewee would not use conjoint analysis.

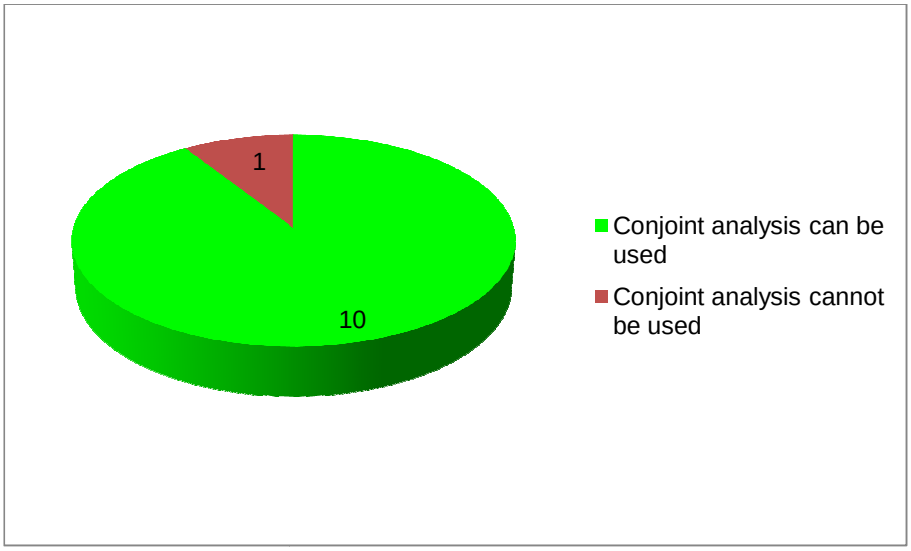


Figure 10. Usefulness of Conjoint analysis to the case company

One interviewee disagreed about using conjoint analysis in case company. He did not complain about the model, but that he could not find features to model. This interviewee was working with software and could not find appropriate features for analysis. He mentioned some features, but was not sure about their usefulness in analysis.

One interesting point, which a few interviewees pointed out, was that different brand choices do not work when questions are asked of dealers. This is because dealers have typically decided to take certain brands into their sales portfolio. If a questionnaire asks them to choose between certain brands, the dealer will not answer or the answer will not be useful. This situation exists because of the market structure in the dental technology business.

One of the interviewees mentioned that conjoint analysis can also be used for making calculation after the market research. For example, conjoint analysis can be utilized to clarify how much customers are willing to pay for certain existing product features. It is known that market and product features are live in the markets and change constantly. A hypothesis would be, for example: “Are customers still willing to pay 500Eur extra to have heated seats in the car?” Definitely conjoint analysis will help in better understanding customers’ purchasing behavior. Typically, a company uses purchase data to investigate what customers are willing to buy. Using a conjoint type of market research, investigation can be made without customer purchases.

Many interviewees pointed out that cultural differences are also important with conjoint analysis. The same interviewees pointed out brand differences and different dealer company structures. Small dealers can have very different views about business than big worldwide dealers. Both answers are very important, but it was pointed out that questions or data sorting must be done separately because of dealer company size and culture.

Some of the interviewees proposed to use the conjoint model to gain a better understanding of different specification combinations. with conjoint analysis, the customer chooses a more comfortable or suitable combination of product specifications. In that case, preliminary work also takes on a very important role and features have to be known well before performing the analysis.

A few interviewees said that conjoint analysis is better undertaken by an outside company, where the analysis technique will be under better control. The interviewees had some ideas about companies which might have the capability to perform conjoint analysis. Some of the interviewees used other companies to undertake market research. They presented how the research was done and results found. Analyses were performed using a quantitative research method, and the questionnaires used Likert scales.

Using an external company is a good way to undertake proper market research. The issue to bear in mind when using other companies is preliminary work. If you use another company to undertake market research, you must undertake proper preliminary work and cooperation with that company. If you are not sure what you want from the market research, you cannot outsource idea making. Also, conjoint analysis is a mathematical method giving outputs from input data. It is not an idea generator. If you have good cooperation with an analysis company, this can help you to perform successful market research, because they have better knowledge about research techniques.

4.4 Ethnographic market research analysis

Ethnographic market research methods were well-known in the case company. Most of the interviewees have had some sort of experience visiting the case company's customers. Almost everybody had contacted dealers, but end customer visits were rarer.

Some of the newest Product Managers did not have experience with end customer visits. Of course, different Product Managers have different priorities. For example, some of the Product Managers can be on the more technical side, and some Product Managers take more action in the business environment.

The ethnographic market research question was given to all fifteen interviewees. All fifteen found it helpful to use ethnographic market research methods in the case company.

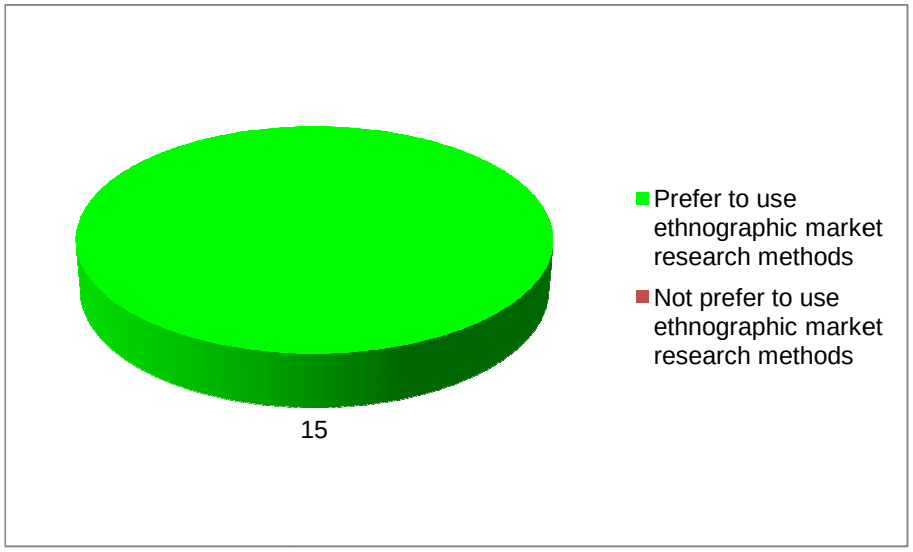


Figure 11. Preference for using ethnographic market research methods

It is very clear that all interviewees hold ethnographic research methods to be very important for the case company. Ethnographic market research was also easy to understand and the interviewees found it very easy to start talking about it. A few interviewees even asked whether things can be done in some other way, or is it possible to develop products without that kind of market research?

The case company has a long background in designing and developing products. Some of the interviewees pointed out that in the last two years customer orientation and customer focus have become a more important issue. In the last few years, the case company has been part of a large US corporation. Clearly the corporation's strategy and business model support customer focus and ethnographical market research methods. Some of the interviewees pointed out these issues strongly, and case company employees have access to corporation best practices.

Ethnographic market research was proposed to be located in the PM2 phase of the case company's current development process. Most of the interviewees said that customer visits and ethnographic market research should be undertaken as early as possible. Some of the interviewees proposed making customer visits even before PM1 or at latest during PM1.

Many of the interviewees also pointed out that the case company undertakes clinical evaluation and in that phase many Program Managers and Product Managers make

customer visits. Clinical evaluation is undertaken during the PM4 phase in the current new product development process. Clinical evaluation visits are a very good opportunity to investigate customer processes more deeply.

To utilize that information in new products requires proper documentation. When the case company makes the clinical evaluation, the product is more or less ready and already designed. Of course some improvements can be made, but this is very limited. The problem is that major product parameters cannot be changed anymore, or at least the whole program would have to postpone the product launch dramatically. In practical terms, that decision cannot be made. Hence, clinical visits are very good opportunity to investigate customer processes, but a system is needed to bring information to the next new product program. In practice, the case company uses the same Product Managers on similar product programs to ensure that information also gets through to the next new product program. Many of the interviewees said that the case company lacks a systematic process to document and create customer investigations.

Almost every interviewee discussed who participates in customer visits. Many interviewees said that it is the Product Manager's task, and the Program Manager should cooperate with the Product Manager. Many of the interviewees prefer the Product Manager and Program Managers to be the people to visit customers concerning market research. Twelve out of the fifteen interviewees agreed that the Product and Program Managers and certain other program members should make market research visits to customers.

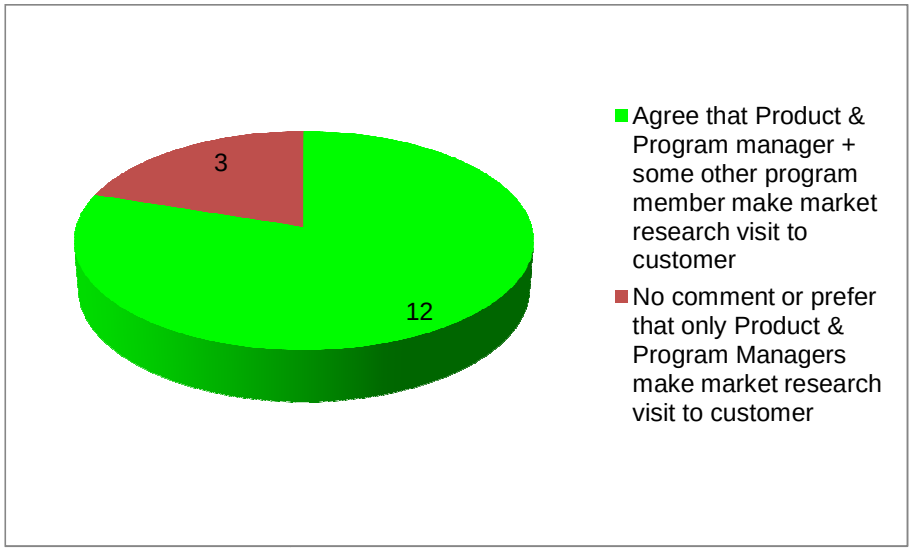


Figure 12. Program members who make market research visits to customers

Interviewees suggested, for example, that:

- every Program Engineer should sometimes visit customers
- case by case, bigger program groups should visit customers
- Software Engineers would participate in customer visits
- main Program Engineers would participate in customer visits
- mechanical engineer would participate to customer visit

Market research visits to customers seems to be an important topic. It is clear that more visits are always better, but of course there are limitations. For example, the visit style varies depending on how many visitors participate. If one or two visitors go to a small clinic, it is more comfortable to discuss with the dentist and nurse. If the number of visitors is, for example, five, it is more likely to be a dentist or nurse presentation about the clinic than market research visit. Another issue is that customers perhaps will not wish to have many visitors to their clinics, because they do not want to disturb their own customers (patients). If a visit is more like presentation, the basic idea of ethnographic market research suffers. The customer is no longer in a comfortable environment, when they have to prepare and give presentations.

Another limitation is cost. More than 90 percent of the case company's customers are abroad. It will cost a great deal of money for the case company to send its employees abroad.

One issue concerning ethnographic market research is that people have very different skills in evaluating environments and processes. Some people can watch the process for a whole day and not see any difference. Others can see different work methods, hear people talking about their working times, etc. Another issue is how different people see different cultures. Some people feel very uncomfortable when they are abroad, but others are interested in the environment, especially the cultural environment.

Some of the interviewees pointed out that Design Engineers should sometimes go to customer clinics. The point here is that during the design phase, the Engineer uses computers a great deal, and 3D design itself is quite complicated, and you have to think about several mechanical details at same time. When the Engineer is designing a specific part, they have to concentrate on other details than usability and customer

need. Of course, the completed assembly or part to be tested is given clinical evaluation, but if a project is very large and the device complex, there is always a risk that the Program Managers must make decisions that are more on the technical side than the customer need side. If Mechanical Engineer visited, for example, once a year to see how their assembly will be used in real life, this may give a good signal to the Engineer to make a better design or at least a design which supports customer needs more.

4.5 Modified QFD model analysis

The QFD model was suggested for use in the case company. In addition, it was suggested that the case company modify the QFD model to utilize it better. This also came up strongly in the data. Its structured way of considering program issues and decisions were seen to be positive features of the QFD model. Most of the critiques considered that the model has been created to use in an environment where markets and product development are in a well-known state and the number of parameters is low. Many of the interviewees work in larger new product programs where the number of parameters is huge. When the number of engineering parameters is huge, there is a risk that many of the important parameters will be unconsidered in the program because the QFD model simplifies engineering parameters. That is of course also a management and decision-making issue, but the QFD model was seen to support decision-making when many engineering parameters need to be discounted.

The modified QFD model formed a question for seven of the interviewees. Five interviewees would use the QFD model in the case company.

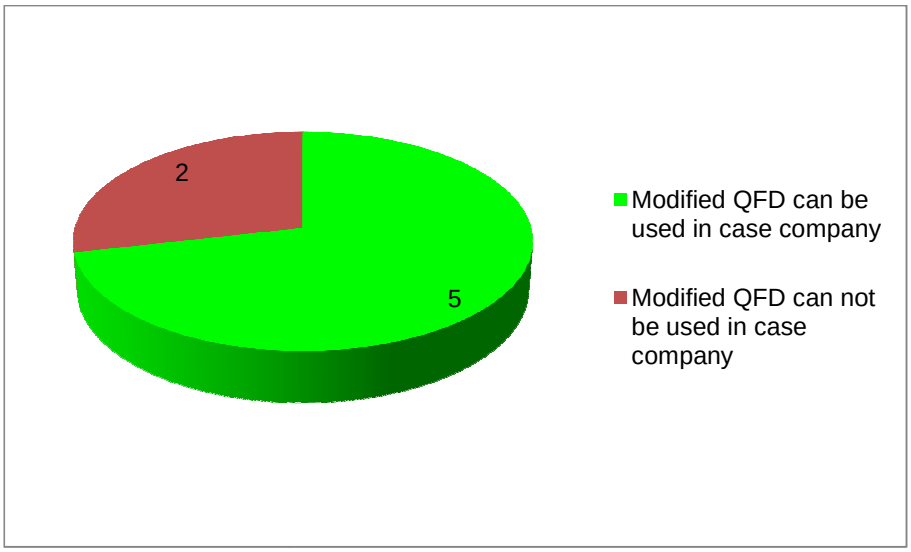


Figure 13. Usefulness of modified QFD for the case company

How data would be collected for the QFD model was one of the topics of most interest during the interviews. The amount of data was seen to be very important. If the program has only some data which can be integrated into QFD, decision-making could be very difficult. This was a comment from interviewees who have at least some experience of using QFD. That is very understandable, because decision-making when lacking data is very difficult and the QFD model does not solve that problem completely.

Another view about the importance of source data was that the QFD model offers the possibility to see things more clearly when the amount of source data is small. For example, if a new product program is designing something very new and has no idea which details are most important, the QFD model can offer the possibility to prioritize different details to produce achievable parameters.

Clearly, the importance of source data was seen from very different angles. Different people see QFD tools and their usage differently, even if interviewees have experience with QFD tools.

Generally, the QFD model was seen as well structured and very strong. That is why many interviewees pointed out that the QFD model and techniques must be known well before use. A few interviewees suggested QFD usage for sub-assemblies, where the amount of data is naturally lower and risks are also lower. One interviewee suggested using QFD for software, where parameters typically need to be chosen systematically and QFD might help to do that. The same interviewee commented that QFD is good as a clarifying tool: “The more foggy the situation is, the more important the usage of QFD”.

One issue which was discussed frequently during the interviews was how QFD presents engineering parameters more visually. Some of the interviewees said that this is one of the greatest benefits of the model, that it visualizes engineering parameters and shows the whole time why certain decisions have been made. This requires that the “House of quality” is displayed on the wall where every program member can see it. It was also seen to be very important to program management that key targets and goals are constantly visualized. This helps program members to remember why they

are doing their everyday jobs. Visualization is also one of the key issues within the new LEAN product development programs.

Negative comments about QFD mostly concerned its complexity and workload. Some of the interviewees could not find resources from the new product program with time to make this kind of analysis. One interviewee had the experience that decision-makers' own views about issues come out too easily from QFD. Resource issues can be improved by making a decision to use QFD before start of the program, and in this case management support is certainly needed.

One critique concerned the fact that decision-making always needs some sort of experienced person, because at least in the medical business field, decisions are complex and must also cover regulatory and quality issues. Any mathematical or systematically made decisions do not consider these issues. Of course, this is again the question of source data and how decisions are to be made.

This issue is not that simple. Using a model does not offer you a ready solution. It must be seen as a tool in some sense. The interviewees who generated that critique know this issue very well, which is why it is a very relevant critique. This critique must be understood, in that using this kind of model can drive the program in the wrong direction, if decision-makers do not have enough experience and competence to make critical decisions.

4.6 Service business approach analysis

Many of the interviewees saw that the service business approach needs to be considered in an early phase of new product development. If customer processes are not examined as early as possible, there is a risk that the whole design does not support customer processes. A few of the interviewees would integrate the service business approach, for example, with the ethnographic market research.

Some of the interviewees pointed out that the case company undertakes clinical evaluations, and according to their understanding, the case company considers service business approach issues during that stage. In clinical evaluation, the medical device will be tested in real dental clinic and end users will give feedback to the case company. During a clinical evaluation, some of the program members, typically Program or

Product Managers, make visits to the chosen clinical evaluation clinic. This is a good point at which to also evaluate the end customer process, for example utilizing ethnographic methodologies described in earlier sections.

Clinical evaluation cannot be the first touch with the customer. The device and offered service must be designed properly before any customer contact, otherwise solving the details can be too time consuming or even impossible, because the program is already in the PM3 – PM4 phase in the new product development process.

A few of the interviewees said that the case company focuses too much on the device and physical product parameters during clinical evaluation. They would prefer to increase service business approach thinking during that program phase. For example, too often the program “forgets” to give all of the designed accessories to the evaluating customer along with the device. In that case, the customer uses their own accessories with the new device and the clinical evaluation does not consider the whole process

Another reason for missing accessories from clinical evaluation is that their design has been scheduled too late and in practice the accessories are not ready when the first clinical evaluation is undertaken. This easily creates a situation where the program decides to make the evaluation “device only”, because this is more important. This is the basic problem, that the whole program must consider the offered product as service, not just a physical device.

Some of the interviewees pointed out that the case company undertakes “use cases” during which the program considers the whole customer process. A “use case” is a tool to be used in the new product program, when the first prototype devices are ready. People outside the program will be chosen to use the new device and report any difficulties and good findings from the device.

Using a “use case” to understand customer processes is one way to better understand customer processes, but typically “use cases” are prepared by the case company’s other employees. This creates a situation where the evaluation is not undertaken like it would be in a real clinic, even if the case company’s clinical specialists undertake the “use cases”. A real customer always has a business view during the service process. The case company’s clinical specialists or other employees do not have the same perspective.

The service business approach as an addition to the case company's design guidelines was a question for seven interviewees. All seven would utilize the service business approach in the case company's new product development process.

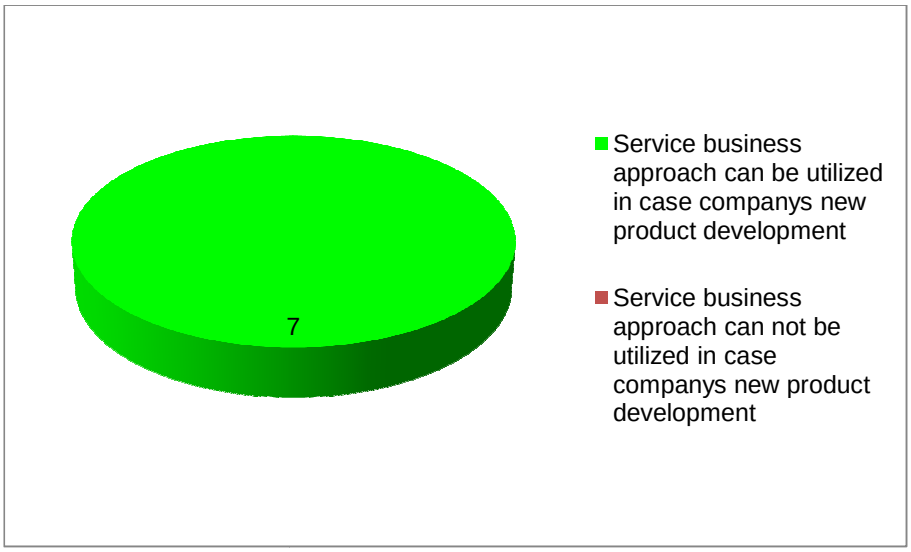


Figure 14. Service business approach utilization in case company's new product development process.

All interviewees were positive about improve customer process thinking in the case company's new development process. As mentioned earlier, the case company is very much a manufacturing company and this can also be seen from these interview results. It is very positive that all of the interviewees see that it must be improved. One interviewee said that the case company can has too old an understanding about customer processes, because it has not focused enough on this issue.

The business environment changes constantly, as does the business environment of the case company's customers. When the case company develops new products, it will always improve understanding of the customer business if the program team concentrates more on customer processes rather than just the physical product.

Many of the interviewees pointed out software usability and understanding customer process in this phase. The case company's business is moving into the 3D world, which means that the case company must concentrate more on that area. 3D imaging requires a lot of computer based actions, created with software. The case company also develops and sells its own software. The interviewees saw that the most important

success factor in software development is how it supports customer processes. If software is complicated to use, most of the 3D imaging process will be complicated.

The case company also sells devices and services to hospitals. Hospitals often have a Radiologist who is working all day with 3D software. If a hospital decides to buy services and devices from the case company, the case company must understand Radiologists' needs and work processes very well.

Other issues which came up from the interviews were location of servers, patient queues and switching between different software. It would be very useful to think about these kinds of issue during new product development. These issues are closer to understanding the customer process, and the service business approach definitely helps to understand these issues better.

Both of the directors with authority pointed out that the case company does not have a dedicated resource for usability. They said that the case company should have a usability designer who concentrates on customer processes, working in the program. This resource could also participate in ethnographic market research and clinical evaluation. One director said that the case company has a "gap" in customer process evaluation in current new product development process.

4.7 Recommendations for new product development process

As described in Section 3.6, conceptual framework, five different models were chosen from the literature to improve the case company's new product development process. Also data was collected using theme interviews to deepen the understanding of the case company's environment and the models' suitability for use by the company. This section presents recommendations for the case company's new product development process.

After analyzing the data, four recommendations for process improvements were put forward:

1. Add market research to the PM1 and PM2 phases of the current process description
2. Use the Kano and conjoint models as market research tools in the PM1 phase
3. Add customer process evaluation to the PM1 phase

4. Use the QFD model as a tool for sub-assembly design

Two other recommendations which are not directly related to the process were drawn out after data analysis:

1. The new product program should have its own resource which brings the customer process view to the program.
2. The management team should pay more attention to the customer process viewpoint, especially software-related program issues, in program milestone meetings.

4.7.1 Market research in PM1 and PM2

Many interviewees pointed out that the case company does not have a systematic method of undertaking market research. This was discussed during many of the questions and can be seen as a major issue.

The case company's process description is very much technology based and marketing and customer related issues are described only in one sentence in PM1: "business case assessment".

It is recommended to add "market research" to the PM1 phase and "market research OK" to the PM2 phase. The idea here is that that program needs to undertake market research during PM1 and market research must be ready before the end of PM2 (see Figure 15).

The case company has undertaken market research in the past, but adding market research to the new product development process makes it more concrete and gives clear sign to the new product development program that market research must be undertaken and preferably documented. According to the interviews, the case company has very good cooperation with customers during the clinical evaluation, therefore market research only needs to be added to the beginning of the program.

4.7.2 Kano and conjoint models as market research tools

Most of the 11 interviewees who discussed them agreed that the Kano and conjoint models can be used in the case company's new product programs (see Figures 9 and 10). Only one interviewee would not use Kano's model and one would not use conjoint analysis. Therefore it is recommended that the program chooses which model they use.

New product programs are very different in the case company. For example, a program can be a facelift only adding a few new features to an existing device, or develop a totally new device utilizing existing known technologies. This definitely affects the market research used. If a program is developing a very new product with new features, using a conjoint model can be very difficult and inefficient.

Many interviewees were very interested in the Kano and conjoint models, but were careful about setting them as mandatory. Using mandatory tools can be problematic and resources can be used in the wrong place. Many of the interviewees saw the Kano and conjoint models as Product Managers' tools for undertaking market research.

Considering all of the issues mentioned above, the Kano and conjoint models were chosen to be tools for market research.

Kano's model and the conjoint model were recommended to use in the PM1 phase in the conceptual framework. These models are suggested to be used as tools, and therefore as tools are not described in the process chart.

4.7.3 Customer process evaluation in PM1

Customer research was seen as a very important issue in the case company's new product development process. All fifteen interviewees were asked about ethnographic market research usefulness for the case company and all fifteen preferred to use ethnographic market research methods (see Figure 11). Also, many of the interviewees pointed out that the customer process view and ethnographic market research are related topics.

Customer processes can be evaluated during ethnographic market research. The only issue is bringing all of the knowledge to other program members. One suggestion is to

have a dedicated resource who brings customer process knowledge to the program (see Section 4.7.5).

Because ethnographic market research is seen as the most important issue for understanding customer need in new product development programs it is recommended that it is placed inside the process in the PM1 phase (see Figure 15). Market research was placed in PM2 in the conceptual framework. Many interviewees pointed out that ethnographic market research needs to be conducted as early as possible., therefore it is chosen to be in the PM1 phase.

Visits to customers were also discussed during the interviews. Twelve of the fifteen interviewees agreed that Program Managers and Product Managers plus some other program member should make market research visits. Some interviewees suggested other choices (see Figure 12).

Customer visits are clearly very important, but the case company lacks a systematic method for these. Therefore it is recommended that the Program Manager and Product Manager will always make market research visits to customers, regardless of the program. The third participant can be chosen by the Program Manager and is also mandatory for every program. It is preferable to choose a program member who is working around the topic where customer understanding is most important. For example, if mechanical details are critical for the customer, the Mechanical Engineer will be chosen; if software is critical for the customer, the Software Engineer will be chosen.

The service business approach was also seen as very useful to the case company. All seven interviewees would state that the service business approach can be utilized in the case company's new product development process (see Figure 14).
To improve the service business approach in case company's new product development process, it is recommended to add "customer process evaluation" to the PM1 phase. When the customer process is described, it drives the program team to concentrate on that issue during PM1 and throughout the process.

The service business approach was recommended to be added to the design guidelines and therefore it is connected to all of the PM phases in conceptual framework. After the interviews it was clear that it must be integrated into the process, because of its importance. That is why customer process investigation is integrated into the PM1

phase. Also it was clear after the interviews that the case company considers customer process very well in the clinical evaluation phase, PM4-PM5 and therefore it is not mandatory to pay attention here to later PM phases than PM1.

4.7.4 QFD model as sub-assembly design tool

Generally the QFD model was seen as a good tool, but the interviewees also pointed out some negative issues. Most critiques concerned its hierarchy and time consuming nature. The QFD model was presented to be used for the whole program and therefore many interviewees pointed out criticisms. The QFD model was discussed with seven interviewees and two said that the model cannot be used in the case company (see Figure 13).

Two interviewees proposed that the QFD model can be utilized in the design of sub-assemblies. Sub-assembly design contains many fewer engineering parameters than whole programs. This creates a situation where use of QFD is much easier and less time consuming. Therefore, the QFD model is recommended for use as a tool to support sub-assembly. It definitely helps Engineers and other program team members to choose the most important engineering parameters.

For example, the QFD model can be used in the design of user interface sub-assemblies. User interface assemblies must be designed based on end customer needs. This is the part which the end customer uses every day and the positions of the buttons and graphics are very important.

Modified QFD was connected to the case company's development process PM2 to PM6 in the conceptual framework. If QFD model tools are used to improve sub-assembly design as mentioned above, the program phase would be the same, PM2 – PM6. Tools are not described in the process chart, because this process chart is a higher level document, where tools are not described.

4.7.5 Own resources for customer process investigation

Many of the interviewees asked the question "who has time to make analysis", or "who has time to use that tool", etc. This is a clear sign that program members feel that they

do not have enough time to make proper analysis and use all tools properly. That is, of course, also a program management and process issue.

Both interviewed directors saw a gap in usability development in the current new product development programs. Therefore it is recommended to have a dedicated resource in the program who brings customer needs into the program and takes care of the usability of product or service.

It is important that this resource works in the program from start to end. Most of the activities are at the beginning of the program, the PM1 and PM2 phases. It is also very important to keep the customer view clear throughout the whole new product development process to ensure its success up until the end.

4.7.6 Directors to pay more attention to customer process related issues

Every interviewee agreed that the customer view is very important for the success of the new product program (see Figures 11 and 14). Also both directors wish to keep this mandatory. Other director said, “it is a foregone conclusion that the customer process view has to be in case company’s design guidelines”. That gives a clear sign that the case company understands very well the importance of understanding customer needs.

Program Managers tend to mainly present technical details and practical issues during project milestone meetings. Therefore it is recommended that management and especially directors with authority pay more attention to customer process related issues during project milestone meetings.

4.7.7 Process chart

Here we describe the recommendations as to how the case company’s current new product development process can be improved. Figure 15 below shows the recommendations for the improved new product development process. The red circles show how customer participation and need have been integrated into it.

PM1 Program start	PM2 Program plan ready	PM3 Specification verified	PM4 Ready for validation	PM5 Ready for pilot deliveries	PM6 Program end
Program Manager allocated Preliminary program plan Business case assessment Technology selected Market research Customer process evaluation	Program plan: objectives, team, tasks, timeline and budget Functional specifications Team allocated Market research OK	Prototype built and tested Specification reviewed and frozen Production capability ramp-up started	In-house clinical evaluation OK Design of all subsystems finished Prototype ready for System test Launch plan ready	System tests and clinical verification OK Regulatory OK Production, S&M and support capability OK	Product optimized based on pilot customer and operations input Full production capability Development team released, handover to maintenance

Figure 15. Recommendations for new product development process

Other recommendations are not directly process related and therefore have only been described in Sections 4.7.5 and 4.7.6.

5 Feedback on recommendations

As mentioned in Section 2, the recommendations were evaluated by interviewing one Program Manager who is dedicated to improving the case company's new product development process. This section describes this interview and the result, and at the end of this section the final recommendations are presented.

5.1 Description of validation

As mentioned in Section 2, it was decided to validate the recommendations through face-to-face interview. The interview began with a description of the overall thesis project and why the interviewee was selected to participate in the validation. All recommendations were presented according to Section 4.7. Figures 3, 7 and 15 were used to support the description of the recommendations.

To support the data analysis and why the recommendations take the form they take, Figures 9-14 were shown to the interviewee. All of the recommendations were described, how they were created and the decisions and data behind them.

The interviewee presented the case company's process description in more detail and showed current documentation around this thesis area. He mentioned that market research is already highlighted quite well in the case company's documentation. It is described as business plan and business case assessment, but this means more or less the same as this thesis project does when it recommends adding market research to the PM1 phase. When the market research is complete, the interviewee did not find any documented evidence in the case company's current process. He mentioned that the case company could make market research more systematic, as some other interviewees had pointed out.

The interviewee did not comment much about the Kano and conjoint models. He was not against them or very excited about them. He agreed about using the Kano and conjoint models as tools.

He mentioned that the new development programs are very different and people like to use different kind of tool, and that is important. He did not consider that mandatory

tools would be beneficial to the case company. The new product development program and especially Product Manager should choose which tools to use in a program

Customer process evaluation he saw to be very important and also he preferred to add it to the process description. He did not comment on which program members should participate in customer evaluation trips.

The QFD model was familiar to the interviewee. He saw that QFD is more like a tool, not as a mandatory system to use, even if it was developed for the case company's use. Again he pointed out that the program should be the decision-maker as to when these kinds of tool will be used.

As for resource and management issues, he did not like to comment. He prefers management to concentrate more on a customer process service business approach. He gave some examples about case company managers who have a management style which supports the customer process view and service business approach. At the moment he sees that the case company does not concentrate enough on customer process. He stated that the case company should sell imaging modules to customers more like a service than a device. If the case company took the service approach more seriously, then for example software related issues will be seen as part of the service process and concentration will be better.

The interviewee pointed out that other work tasks have been more important than new product development process improvement. This affected his responses and perhaps he felt a little uncomfortable because of that. He explained that he has accepted updating the case company's current new product development process using the LEAN production development tools presented in Section 1.

The interviewee emphasized the importance of fresh ideas and best practices to the case company, hence he was not at all against all of the presented models. He implied that integrating the presented models into the case company's process should perhaps be left to someone else. He did not mention that directly, but he did not openly take on the task himself to make the proposed recommended changes to the case company's process.

5.2 Final recommendations

During the evaluation interview it became quite clear that market research issues are described quite well in the case company's current new product development process, although they are described as business plan and business case assessment. Those two issues clearly also include market research.

During evaluation interview the case company's detailed process documents were also reviewed. The interviewer and interviewee pointed out that market research is described but is definitely less structured than other tasks during PM1 in the case company's current process. Therefore it is recommended to update the case company's detailed documents in this area. The recommendation to update the case company documents is described more accurately in the practical implications in Section 6.2.

The first recommendation for the case company's new development process was to add "market research" to the PM1 phase. It was decided to remove this, because the document update better fits the case company's practical use.

"Market research OK" was added to the case company's process in PM2 when the first recommendation was made in Section 4. This is clearly still important after the evaluation interview. During the evaluation interview it was noted that the case company's current process does not sufficiently support when the market research is to be undertaken. Therefore "market research OK" will be retained in the final recommendations.

During the evaluation interview, the Kano and conjoint models were presented to use as tools. The interviewee was not against the use of these models. Therefore the Kano and conjoint models retain their place in the final recommendations. It is possible that the evaluation interviewee feels that the Product Manager is the person who needs to undertake this kind of activity during the new product development program. He did not mention this, but according to the other interviews, the Product Manager has been the key person who has undertaken that kind of activity previously.

Customer process evaluation was again seen to be the most important market research tool for the case company during the evaluation interview. In the initial recommendations, "customer process evaluation" was added to the PM1 phase of the case

company's current new product development process. It was decided to retain this in the final recommendations, because of its high importance for the case company.

During the evaluation meeting, the QFD model was discussed. Again, the model was not seen to be the best option for all programs, but it could work as a tool for improving understanding customer needs in the case of sub-assemblies. In the initial recommendations, the QFD model was suggested for use in sub-assemblies. The evaluation interview did not change that. Therefore the final recommendation will be the same concerning the QFD model.

Two more recommendations were made in Section 4: Dedicated resource for customer process investigation and directors paying more attention to customer process related issues. These topics were also discussed during the evaluation interview. The interviewee did not like to comment on management issues, however, he was not against this kind of change. Therefore these two topics retain their place in the final recommendations.

Changes to the initial recommendations have been described above. The initial recommendations were then developed after the evaluation interview. The list and Figure 16 below illustrate the final recommendations.

- Customer process evaluation added to PM1
- Market research to be undertaken before PM2
- Kano and conjoint models to be used as market research tools
- QFD model to be used as a sub-assembly design tool
- Dedicated resource for customer process investigation
- Directors to pay more attention to customer process related issues

PM1 Program start	PM2 Program plan ready	PM3 Specification verified	PM4 Ready for validation	PM5 Ready for pilot deliveries	PM6 Program end
Program Manager allocated Preliminary program plan Business case assessment Technology selected Customer process evaluation	Program plan: objectives, team, tasks, timeline and budget Functional specifications Team allocated Market research OK	Prototype built and tested Specification reviewed and frozen Production capability ramp-up started	In-house clinical evaluation OK Design of all subsystems finished Prototype ready for System test Launch plan ready	System tests and clinical verification OK Regulatory OK Production, S&M and support capability OK	Product optimized based on pilot customer and operations input Full production capability Development team released, handover to maintenance

Figure 16. Final recommendations for new product development process

6 Conclusion

This section will draw conclusions about this thesis project. The section begins with an executive summary, contains practical implications and ends up with an evaluation describing how reliability and validity have been considered during the thesis project.

6.1 Executive summary

The idea for this thesis project came up when the author was working in a new product development program. The program is the first new more LEAN new product development program in the case company, which highlights the fact that the case company needs to change its new product development process. LEAN is very much a production-oriented development method, hence the case company must take care that customer focus does not suffer.

The situation in case company and the specific new product program creates a business problem and the objective was created according to that. The objective is to offer recommendations for an improved new product development process to the case company which integrates customer participation and need into the process.

After setting a target, the author undertook a literature review to discover how other companies have integrated customer needs into their new product development processes. Five best practices were found: Two market research models, one comprehensive program model and two customer process investigation related methods.

After the literature review, fifteen interviews were conducted at the case company to improve knowledge about the usefulness of these five best practices for the case company. Generally the models were seen positively and some of the interviewees were very excited about the models. For example, all of the interviewees liked the service business approach and customer process evaluation techniques.

After the interviews, recommendations for the new production development process ere developed. The recommendations covered six issues. Four were directly process related and two not directly process related.

Validation of the recommendations was conducted after the interviews. One of the case company's Program Managers as dedicated to the validation. Not many changes were made after validation. Only the addition of market research to the process was removed from the recommendations, because it was seen to be more practical to the case company to add it to the detailed documentation.

After validation, the final recommendations were developed. The final recommendations for improving the case company's new product development process are to:

- add "customer process evaluation" to PM1 in the higher level process chart
- add "market research OK" to PM2 in the higher level process chart
- use the Kano and conjoint models as market research tools
- use the QFD model as a sub-assembly design tool
- have a dedicated resource for customer process investigation
- have Directors pay more attention to customer process related issues

In the validation interview it was noted that the case company does not have a dedicated person to make the suggested changes to processes and documents. The validation interviewee pointed out that he was dedicated to making other changes not total process changes. Therefore the next step after that thesis project is to create a release letter about this thesis and send it to the Directors who have authority to change processes. If these directors agree with these changes, they can make them happen in the case company. This will improve the case company's new product development process and integrate customer participation and needs into it.

The author's knowledge about customer orientation, R&D and marketing has increased greatly during this thesis project. It is not easy to learn about matters that belong to other departments. Cross functional cooperation works very well in the case company, but practically it does not increase knowledge about other departments. To deepen understanding about other department related issues requires a real jump into other areas, and conducting this thesis project has offered that opportunity.

Many of the interviewees pointed out that that case company will draw good benefits from this kind of thesis project. This is gives the case company knowledge about how things have been done in other companies and how to best understand customer needs nowadays. Of course, the knowledge is based on journals and other literature

and does not contain direct examples of what other companies are doing, but it is definitely better than nothing.

6.2 Practical implications

The case company uses an overall description of a systematic new product development process. The same kind of model has been used in this thesis project. The recommendations for the overall systematic new product development process are the same as the final recommendations given at the end of Section 5 (Figure 16). The red circles would of course be removed before use.

Customer process evaluation was one of the final recommendations in Section 5. The case company operates in the medical business area which means that it has very tight quality and documentation requirements. Also the case company's new product development process is described in the company's quality manual. The quality manual includes one general document, where program milestone processes are described in more detail. Every project milestone (PM) step is shared in smaller details and documents. Customer process evaluation issues are recommended to be added under the business plan category. As already noted in Section 4, every interviewee preferred to use ethnographic market research in new product development. It is recommended to add this under the business plan category in the general document which describes the program milestones.

Market research was included in the overall process description in the initial recommendations (see Figure 15) and removed from there because the documentation was considered to be more practical for the case company's use. As mentioned above, the case company has a general document describing milestones, and it is recommended that market research is added under the business plan sub category. Also there can be additional references to using market research tools such as Kano's model or conjoint analysis. It is important that the program includes choosing market research methods and tools during PM1.

The Kano and conjoint models were also included in the final recommendations at the end of Section 5. The most important issue is that the program knows about the different models that are available and makes a choice as to which to use. It has been ex-

plained above how the models are recommended to be included in the general PM document.

The Kano and conjoint models were presented to all Product Managers except one who was not able to participate in the interviews. That has already brought knowledge to the case company about the models. As mentioned in Section 4, the case company can make an analysis or use an external analysis company. It is recommended that the case company uses an external company to make the first analysis. If the case company decides to create its own Kano's and conjoint analysis, the models must be documented.

The QFD model was also included in the final recommendations. It is suggested to use this as a sub-assembly design tool. The case company has at least some experience in using it. Using a QFD model does not require direct documentation. Of course it has some documentation itself. Therefore it is recommended to add to the general PM description document as to whether the program uses the QFD model for sub-assembly. Again, it is important that the program makes the decision whether to use it.

A dedicated resource for customer process related issues was included in the final recommendations. If the case company decides to create that kind of new role, at least a job description needs to be created. This is a document which describes the basic purpose of the position, main work tasks, responsibilities and connections within the organization as well as customer connections. The job description needs to be created before the case company hires or make such a new job announcement.

6.3 Evaluation

Here the author compares the objective of this thesis to the results and we come back to reliability and validity, considering how the issues presented in Section 2.3 have been implemented throughout this thesis project.

6.3.1 Objective vs. results

The objective of this thesis was to establish an improved version of the case company's product development process, which integrates customer participation and cus-

tomer need into the process. If we simplify the results, six recommendations have been presented in conclusion.

It is clear that these six issues are strongly related to customer participation in the new product development process. The higher level process flow also has additions which help the program team to make the development work more from the customer perspective.

The issues are clear, but the conclusion suffers a little, because the evaluation was made by the Program Manager who was dedicated to improving the process. During the evaluation, it was noticed that the Program Manager had more important work tasks to do and suggested improvements to be made after this thesis project. This led to a situation where real process improvement was not made during this thesis project and implementation will be made later. Hence it can be said that improved product development processes were not established.

This thesis project went in a very straightforward way and figures and flow charts were created to support that. First the current case company's systematic development process was shown in the business problem. Then research process was illustrated in Section 2 as a flowchart. The best practices in Section 3 concluded with a conceptual framework figure where the case company's existing new development process was presented and the five best practices integrated into different project milestones. This was a clear way to illustrate the conceptual framework and it supported the thesis objective very well. Also it makes matters easy for the reader that the five best practices are the theme interview questions for interviews, making it easier to follow the data analysis.

In the data analysis section, different suggested models were illustrated in different sub sections and the end of Section 4 includes the recommendations for the new product development process. The recommendations were built in Section 4.7, where all recommendations were illustrated in different sub sections. In Section 4, the data analysis was made systematically, but when different suggestions were considered separately, it might be hard to see a comprehensive picture of the topic.

At the end of Section 4, the case company's systematic development process chart was illustrated with the developed recommendations. The process chart and recom-

mendations again answered the objective quite well. The post-evaluation change was described quite systematically and it was easy to follow how the thesis project came to the final recommendations for the case company's new product development process.

This thesis project answers its objective well, even though the improved version of the case company's development process was not established during the timescale of the thesis project. The outcome of the thesis is clear and suggestions are simplified sufficiently. The recommendations can be implemented in the case company's documentation without a huge amount of work.

6.3.2 Reliability and validity

One key reliability issue during this thesis project has been that all actions will be explained, what, why and how they have been made.

For example, in Section 4, interviews were presented and data were analyzed. All models were developed in such a way as to be more suitable for the case company's use. The reader was told if something was left out and why certain decisions were made. The other sections followed the same principles and therefore it can be stated that this thesis follows this key principle from start to end.

As described in Section 2.3, Tuomi and Sarajärvi list some basic details which need to be considered when the reliability of research is estimated. [15] Now those issues will be evaluated by the author, as to how this thesis project fulfills these issues.

- Purpose and objective of research

The purpose of this thesis project is presented in Section 1.2. The objective is presented visually.

- Own commitment as a researcher in this research

The author of this thesis is working in the case company as a Production Manager, and most of the activities are prepared in other case company departments. For example, data was collected from the R&D and marketing departments which helped the author to take their researcher role.

- Data collection

Data was collected by theme interviews. This is documented in Section 2.

- Research data sources

Data sources were selected and selection was documented in Section 2. Data sources were also freely investigated during interviews and notifications described in Section 4.

- Source–researcher relationship

This was explained in Section 2. Some of the interviewees work in same program in cooperation with the author and some others have worked before in cooperation with the author. The researcher works in a different case company department which increases reliability.

- Research schedule

The research was conducted in the case company environment and the thesis explains the time frame within which all interviews were performed. Also the business environment situation was explained.

- Data analysis

Data analysis was conducted in Section 4. The results are not based on averages or other mathematical parameters. Hence this thesis project follows the qualitative research approach to data analysis.

- Reliability of research

Reliability was taken into consideration in Section 2.3. This section is dedicated to evaluating the discussion in Section 2.3.

- Research reporting

This thesis project has been undertaken according to a qualitative research approach and this document is the outcome of this project. References were used throughout the report to enhance the scientific writing style.

It was planned to validate the initial recommendations through an interview with a dedicated Program Manager. This validation interview was prepared after the initial recommendations were made. All recommendations were accepted, except “market research”, which was corrected before the final recommendations. This gives a clear sign

that all of the recommendations were suitable for the case company. Also the validation interview was described properly to ensure the reliability of the interview and validation.

If any other researcher took the same path as the author of this thesis, the results and output would probably be the same.

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Theme interview form for understanding customer needs in new product development

Theme interview x / person x

Date:_____

Person:_____

Question 1

Kano's model - integration into the case company's systematic development process Milestone 1

Question 2

Conjoint analysis - integration into the case company's systematic development process Milestone 1

Question 3

Ethnographic market research - integration into the case company's systematic development process Milestone 2

Question 4

QFD model - integration into the case company's systematic development process Milestones 2 – 6

Question 5

Customer process view in relation to the case company's design guidelines

Teemahaastattelulomake asiakkaan tarpeen ymmärtämisestä uuden tuotteen kehittämisessä

Teemahaastattelu 1 / henkilö 1

Päiväys:_11.2.2013_____

Henkilö:_____

Kysymys1

Etnograafisten markkinatutkimusten käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2 vaiheeseen

PM1-PM2, pakotus ”-”, ED3 mukaan

Jokaisen insinöörin olisi hyvä joskus, jossakin programmissa käydä asiakkaalla

Kysymys 2

QFD-mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2- PM6 vaiheisiin

”-” Oma malli olis hyvä -> olis hyvä olla case yritys-malli, joku kehittämään ja ylläpitämään sitä

Valmiin mallin tuominen sellaisenaan ei hyvä

Kysymys 3

Asiakas prosessin näkökulma case yrityksen suunnittelu ohjeisiin

Usability prosessi on periaatteessa tätä -> ei ole checklistoja tai muutakaan seurantaa tällä hetkellä käytössä

Muuta:

Systemaattinen käytettävyysanalyysi puuttuu case yritykseltä

Päivän loppupalaverit vois olla hyvä malli, varsinkin niin, että isonmpi ENG-kokonaisuus kokoontuu päivän päätteeksi (hyvä kommunikointitapa)

Teemahaastattelulomake asiakkaan tarpeen ymmärtämisestä uuden tuotteen kehittämisessä

Teemahaastattelu 2 / henkilö 2

Päiväys:___11.2.2013_____

Henkilö:_____

Kysymys1

Etnograafisten markkinatutkimusten käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2 vaiheeseen

-pitäis olla PM1 ja PM2 välissä. PM2 ehkä myöhäinen

-Toisessa yksikössä on käytetty aikaisemmin (kaikki insinöörit)

-voisi olla myöskin prosessissa, ei haittaisi ollenkaan

Kysymys 2

QFD-mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2- PM6 vaiheisiin

”+” -prosessi voi olla kankea, kuka ehtii tehdä?

-toimiva, ei ehkä täysin sellaisenaan, mutta periaate hyvä

Kysymys 3

Asiakas prosessin näkökulma case yrityksen suunnittelu ohjeisiin

- arkkitehtuuri speksi (Use case)

Muuta:

-Mielenkiintoista, että nykyään R&D tekee tuotteen tuotannolle, ennen tehtiin vain asiakkaalle

-Case yrityksessä parannettavaa juuri systemaattiselle asiakkaan tarpeen ymmärtämiselle

Teemahaastattelulomake asiakkaan tarpeen ymmärtämisestä uuden tuotteen kehittämisessä

Teemahaastattelu 3 / henkilö 7

Päiväys:___12.2.2013_____

Henkilö:_____

Kysymys 1

Kano'n mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen

-markkinakypsyys vaikuttaa
-aika sidonnainen
-tehokas malli
-voisi testata programmissa

Kysymys 2

Conjoint analyysin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen

-pitää olla kategorisointi
-on kokemusta käytöstä
-haastava nähdä kysymysten taakse
-segmentointi
-hyvä siitä, että saa hinta kysymykset mukaan
-hyvä vertailuun

Kysymys3

Etnograafisten markkinatutkimusten käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2 vaiheeseen

-ensiarvoisen tärkeää -> pitäisi olla osa prosessia
-pääinsinöörit ainakin tähän mukaan
-laiteasennus myös tähän mukaan

Muuta:

- Haastateltava pyysi Kanon mallista materiaalia, joka lähetettiin hänelle haastattelujen jälkeen.

Teemahaastattelulomake asiakkaan tarpeen ymmärtämisestä uuden tuotteen kehittämisessä

Teemahaastattelu 4 / henkilö 3

Päiväys:___12.2.2013_____

Henkilö:_____

Kysymys 1

Kano'n mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen
-voisi käyttää oikeasti
-esikysymykset?
-ajatusmallia on käytetty
-asiakastutkimusmallilla kysymysten muodostaminen?
-eri kyselyt eri kulttuureihin
-onko iso vai pieni klinikka?
-saataisiin voluumia

Kysymys 2

Conjoint analyysin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen
-tätä voisi käyttää samalla tavalla
-neljä kuvitteellista vaihtoehtoa
-voisi käyttää oikeasti

Kysymys3

Etnograafisten markkinatutkimusten käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2 vaiheeseen

-tuotepäällikkö + hankepäällikkö + kiertävä programmin jäsen
-ei paraatikäyntiä (liikaa osaanottajia ja järjestetty tilaisuus)
-asiakasprosessin tutkiminen hyvä -> ulkopuolinen tarkkailija näkee paremmin
-pieni asiakas voi olla hyvä tutkimuskohde -> eri näkökulma
-henkilösuhteet tärkeitä yhteistyön kannalta
-tämä erittäin tärkeää

Muuta:
-jakelija -> myyjät -> tuotepäälliköt -> tuotekehitys (etnografinen tutkimus korjaa tämän)
-jakelijat ja loppuasiakkaat tutkitaan erikseen -> näin on tehty ja hyväksi havaittu

Teemahaastattelulomake asiakkaan tarpeen ymmärtämisestä uuden tuotteen kehittämisessä

Teemahaastattelu 5 / henkilö 6

Päiväys:_____14.2.2013_____

Henkilö:_____

Kysymys 1

Kano'n mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen -sopisi "attractive" tyylisten asioiden löytämiseen -"+"
-tulevaan programmiin hyvä -PM2 mennessä
-featureiden hakemiseen hyvä

Kysymys 2

Conjoint analyysin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen -eri speksi kombinaatiot voisi kokeilla -"+"
-enemmän silloin, kun on jo käsitystä enemmän

Kysymys3

Etnograafisten markkinatutkimusten käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2 vaiheeseen

-lähellä Case yrityksen konsernin mallia
-harjoitettu case yrityksessä jonkin aikaa
-asiakkaalle max 1-2 henkilöä kerralla (heterogeeninen porukka olis hyvä)

Kysymys 4

QFD-mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2- PM6 vaiheisiin -käyttäminen vaatii ymmärrystä tekniikasta ja käyttöympäristöstä
-vaatii vakiintuvan ymmärryksen ja ympäristön
-voisi käyttää vaikka jossain pienemmässä kokonaisuudessa

Kysymys 5

Asiakas prosessin näkökulma case yrityksen suunnittelu ohjeisiin

-Osa case yrityksen konsernin mallia
-Case yrityksellä saattaa olla esim. vanhentunut käsitys asiakkaan prosessista
-Softat olisi tärkeä osa-alue
-ei eri ohjelmissa hyppimistä (excel/word esimerkki)

Teemahaastattelulomake asiakkaan tarpeen ymmärtämisestä uuden tuotteen kehittämisessä

Teemahaastattelu 6 / henkilö 5

Päiväys:_____15.2.2013_____

Henkilö:_____

Kysymys1

Etnograafisten markkinatutkimusten käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2 vaiheeseen -hyvä, jos mennään uuteen laitesegmenttiin

–case yrityksen konsernin systeemin hengessä voisi olla hyvä

-vanhoissa programmeissa on jo hyvin referoitu

-iso vierailijaryhmä asiakkaalle kallista -> ei hyvä (ehkä tapauskohtaisesti)

Kysymys 2

QFD-mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2- PM6 vaiheisiin -raskas malli -on kokemusta

-tekijän päätös tulee helposti läpi -valtava ”priorisointitaulukko”

-vaatii massiivisia kyselyitä, jotta on luotettava

- ei usko, että matemaattinen malli tarjoaa pelkästään ratkaisun. Tarvitaan asiantuntija arvio mukaan.

Kysymys 3

Asiakas prosessin näkökulma case yrityksen suunnittelu ohjeisiin

-ei sanota suoraan, ei ohjetta

-koneen suunnittelu, ei ohjetta

-katselmoinnissa enemmän tämän kaltaista ajattelua

-perusprosessi on hyvin hanskassa

-2D istuu hyvin, mutta 3D –maailmassa vielä hiomista

Teemahaastattelulomake asiakkaan tarpeen ymmärtämisestä uuden tuotteen kehittämisessä

Teemahaastattelu 7 / henkilö 4

Päiväys:____18.2.2013_____

Henkilö:_____

Kysymys 1

Kano'n mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen -ei ole vakuuttunut, että tämä toimisi - järkevä

-ei staattinen, vaan "hetken kuvaus"

-työkalu itsessään ei ratkaise ongelmaa

-jos lähtötilanne on sumea, tuloksesta tulee myös sumea

Kysymys 2

Conjoint analyysin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen -tämä on uskottavampi ja parempi, kuin Kanon malli

-toimii hinnoittelun apuvälineenä

-on käytetty aikaisemminkin

Kysymys3

Etnograafisten markkinatutkimusten käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2 vaiheeseen

-Kuin vaatimus

-laajasti käytössä -> hyvä malli

Muuta:

- attractive tärkeä elinkaaressa
- yksilöiltä tulee ideoita ja se on tärkeää
- työkaluja, jotka olisivat "pakissa"

Teemahaastattelulomake asiakkaan tarpeen ymmärtämisestä uuden tuotteen kehittämisessä

Teemahaastattelu 8 / henkilö 11

Päiväys:_____21.2.2013_____

Henkilö:_____

Kysymys 1

Kano'n mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen
-palaute tytäryhtiöiltä bencmarking mielessä
-maakohtaisia eroja
-kyselyjä tehty dealereille
-collaboration teema otettu käyttöön
-, kun must-be:stä saadaan tehtyä Attractive tyytyväisyys paranee

Kysymys 2

Conjoint analyysin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen
-mitkä ovat parametrit softien suhteen, ehkä alusta tai tietokanta?
-pystyykö tätä käyttämään softien suhteen?

Kysymys3

Etnograafisten markkinatutkimusten käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2 vaiheeseen
-tehdään itse ja on hyvä malli
-after sales, markkinointi ja myynti
-puhuttu, että pitäisi olla systemaattisempaa ja lisätä tätä toimintaa

Teemahaastattelulomake asiakkaan tarpeen ymmärtämisestä uuden tuotteen kehittämisessä

Teemahaastattelu 9 / henkilö 14

Päiväys:_____25.2.2013_____

Henkilö:_____

Kysymys 1

Kano'n mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen

-ei systemaattisesti käytetty
-tulee lähinnä tuotepäälliköiltä
-vaativuusmäärittely
-uuden konsernin myötä enemmän asiakas mukana
-tuotepäällikköjentyökalu(ei pros.)

Kysymys 2

Conjoint analyysin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen

-tätä ei tietääkseen käytetty
-ei systemaattisuutta

Kysymys3

Etnograafisten markkinatutkimusten käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2 vaiheeseen

-kiertoa käytetty
-pitäisi tehdä enemmän loppuasiakkaan tutkimusta
-kliinisissä tehdään PM3-PM5
-pilotointi suunnitelma
ei tehdä riittävästi -> enemmän pitäisi tehdä -> olisi hyötyä
-pitäisi tehdä aikaisemmassa vaiheessa ennen PM2
-Tuotepäälliköt, hankepäällikkö, tuotekehittäjät silloin tällöin (insinööri perehdytyksessä, sekä insinöörejä voisi lähettää näyttelyihin)

Kysymys 4

QFD-mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2- PM6 vaiheisiin

-ei ole systemaattisesti käytetty
-hyvä työkalu sopivasti käytettynä
-työkalu vaatimusten priorisointiin
-hallittavuus menee, jos on liikaa tekijöitä
-menettelytapa

Kysymys 5

Asiakas prosessin näkökulma case yrityksen suunnittelu ohjeisiin

-Softissa tehdään Use caseja
-Ei ole varsinaisesti käytettävyys suunnittelua
-palveluprosessin suunnittelussa gäppi
- Onko itsestään selvyys, voiko toisin tehdä?
- sisään rakennettu
MUUTA:Nämä nimenomaan työkaluja asiakkaan tarpeen määrittelyssä -> käyttö harkintaa käyttäen

Teemahaastattelulomake asiakkaan tarpeen ymmärtämisestä uuden tuotteen kehittämisessä

Teemahaastattelu 10 / henkilö 11

Päiväys:_____25.2.2013_____

Henkilö:_____

Kysymys 1

Kano'n mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen -miten hintalappu vaikuttaa tähän?

-ensin hintakartoitus

-ei kysytä sellaista, mitä asiakas ei tiedä

Kysymys 2

Conjoint analyysin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen -hyvinkin voisi olla tällainen malli -tämän kaltaisia on ollut

-piilo-ominaisuuksi "mielikuvat", voi ohjata harhaan

-voisi teetättää myö ulkopuoleisilla

-dealerit ja loppuasiakkaat, tutkimus erikseen

-voisi käyttää business planissa

-ominaisuuksien rakentamiseen

Kysymys3

Etnograafisten markkinatutkimusten käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2 vaiheeseen

-mitä aikaisemmin, sitä parempi

-voi olla haasteellista mennä asiakkaalle

-täytyy tuntea myös asiakkaan tekeminen

-henkilöityy -> erilaisuutta

Teemahaastattelulomake asiakkaan tarpeen ymmärtämisestä uuden tuotteen kehittämisessä

Teemahaastattelu 11 / henkilö 8

Päiväys:_____26.2.2013_____

Henkilö:_____

Kysymys1

Etnograafisten markkinatutkimusten käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2 vaiheeseen -tehty aikaisemmissa programmeissa

-kilpailijoiden laitteita voidaan tutkia -kliiniset spesialistit

-vanhoja katselmoitaessa voidaan myös kartoittaa uusia featureita

-tuotannon ihmsille ei välttämättä hyötyä käydä asiakkaalla (softari olis parempi)

Kysymys 2

QFD-mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2- PM6 vaiheisiin -tulee MRS-speksistä programmiin (by Marketing vastaava)

- QFD ehkä korvaa MRS-speksin

-dokumentointi

-MRS:stä system requirement

-ei näkyvillä, tulee vähän niin kuin valmiiksi

-työkaluna voisi käyttää

Kysymys 3

Asiakas prosessin näkökulma case yrityksen suunnittelu ohjeisiin

- on otettu huomioon nykyisessä programmissa
- lääkärit ja klinikat erilaisia ja kaikkia ei voi palvella -> meidän tehtävä on tehdä mahdollisimman hyvä palvelu

Teemahaastattelulomake asiakkaan tarpeen ymmärtämisestä uuden tuotteen kehittämisessä

Teemahaastattelu 12 / henkilö 12

Päiväys:_____26.2.2013_____

Henkilö:_____

Kysymys 1

Kano'n mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen -voidaan jaotella hyvin ominaisuuksia

-dealer ja loppuasiakas erikseen

-kilpailu kova -> asiakkaat ostaa, mitä haluavat -> malli hyvä

-kysymykset tapauskohtaisesti

Kysymys 2

Conjoint analyysin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen -pitää olla hintaluokka, mistä valita

-kipurajat tunnetaan nykyään jo tarkkaan

-dealerit myy tiettyä brändiä, kuinka tätä voi käyttää?

Kysymys3

Etnograafisten markkinatutkimusten käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2 vaiheeseen

-kuulostaa hyvältä

-meillä korostettu

-kannattaa laittaa laitteita kliinisiin

-hankepäällikkö ja tuotepäällikkö, mekaniikka muunnittelija

-jos palaute tulee monen ihmisen kautta, se ei toimi -> palaute suoraan on hyvä

Muuta:

-Case yrityksessä tehty konsernissa käytettävää mallia

Teemahaastattelulomake asiakkaan tarpeen ymmärtämisestä uuden tuotteen kehittämisessä

Teemahaastattelu 13 / henkilö 15

Päiväys:_____27.2.2013_____

Henkilö:_____

Kysymys 1

Kano'n mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen -on hyvä malli ja käytetäänkin
-designin hakemisessa
-ehdottomasti käyttöön

Kysymys 2

Conjoint analyysin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen -featuret olemassa (täytyy olla olemassa)
-dealereilla eri intressi -jälkilaskelma
-kysymykset valittava tarkkaan
-jakelijat valittava tarkkaan

Kysymys3

Etnograafisten markkinatutkimusten käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2 vaiheeseen -kulttuuriset tavat nähdään paremmin
- ehdottomasti -heikkojen signaalien monitorointi -henkilökysymys
-laitteiden pakkaaminenkin tutkittava -pitäisi ohjeistaa jne.
-Käytettävyys suunnittelija + tuotepäällikkö

Kysymys 4

QFD-mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2- PM6 vaiheisiin -hyvä malli varsinkin silloin kun on softa kyseessä
➔ vaatii systemaattisuutta ja tämä malli tarjoaa sitä
-mitä utuisempi asia, sitä parempi tämä malli on

Kysymys 5

Asiakas prosessin näkökulma case yrityksen suunnittelu ohjeisiin
-pitäisi ottaa huomioon
-3D:ssä varsinkin (serverihuone, potilasjonot ja radiologi voi olla esim. kauempana)

Teemahaastattelulomake asiakkaan tarpeen ymmärtämisestä uuden tuotteen kehittämisessä

Teemahaastattelu 14 / henkilö 9

Päiväys:_____27.2.2013_____

Henkilö:_____

Kysymys 1

Kano'n mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen -ei olla käytetty aikaisemmin
-täytyy tietää parametrit ennakkoon

Kysymys 2

Conjoint analyysin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen -tätä on käytetty ja toimii hyvin

Kysymys3

Etnograafisten markkinatutkimusten käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2 vaiheeseen

Muuta:

- Attractive featuret ei aina mene nopeasti vanhaksi
- use casen kautta voi tulla "WOW-juttuja"
- myynti meettingit toimii hyvin datan keräykseen
- aikaisemmilla tuotteilla on onnistuttu tekemään markkinatutkimus
- asiakkaan tarpeen määrittelyä on tehty vanhan datan mukaan
- must-be saattaa olla sama kuin "industrial standards"
- Kannattaa kyseenalaistaa myös se, kuinka kuvia tulkitaan (lääkäri tulkitsee kuvia eri tavalla)

Teemahaastattelulomake asiakkaan tarpeen ymmärtämisestä uuden tuotteen kehittämisessä

Teemahaastattelu 15 / henkilö 13

Päiväys:_____5.3.2013_____

Henkilö:_____

Kysymys 1

Kano'n mallin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen -riski, että asiakas haluaa kaikki varusteet
-tällaisten mallien riski on se, että selvää vastausta ei saada
-datan visualisointi on haaste
-havinnollinen tapa
-ei ole käyttänyt aikaisemmin

Kysymys 2

Conjoint analyysin käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM1 vaiheeseen -kun tiedetään riittävällä tarkkuudella speksit, niin toimii
-jos on kilpailevia vaihtoehtoja, niin tämä on hyvä

Kysymys3

Etnograafisten markkinatutkimusten käyttöönotto case yrityksen systemaattiseen kehitysprosessiin PM2 vaiheeseen

-mitä aikaisemmin sitä parempi
-tuotehallinta, myyjät ja tuotekehitys
-koko ympäristön näkeminen hyvä asia
-projektipäällikkö avainasemassa
-PM2 jälkeen myös voisi olla hyvä, jos muutetaan parametrejä, niin pitäisi käydä uudelleen asiakkaalla.